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Clinical pathological conference

■ *Irving Meyer,* D.M.D., D.Sc., Springfield, Mass.; Richard W. Tiecke,† D.D.S., Chicago; Martin S. Protzel,‡ D.D.S., Newark, N. J.; Herbert J. Bloom,§ D.D.S., Detroit, and S. Elmer Bear,‖ D.D.S., Richmond, Va.*

Three case reports concerned with infection and neoplasia are presented in a thought-provoking manner. The value of careful differential diagnosis and inductive reasoning is emphasized.

A clinical pathological conference was presented at the fortieth annual meeting of the American Society of Oral Surgeons which was held in New York, September 9-12, 1959. The moderator for the conference, who presented the case histories, was Irving Meyer. The clinicians and pathologist who discussed them were Martin S. Protzel, Herbert J. Bloom, S. Elmer Bear, and Richard W. Tiecke.

■ *Case 1*

The patient was admitted on Sept. 21, 1949, with a complaint of "a hole in the roof of my mouth." He reported that approximately one month prior to admission, while eating fish, a bone had become stuck in the roof of his mouth. He removed it without effort or pain. About three or four days later he had noticed a small communication between his mouth and his nasal cavity through which fluids entered into his nose while drinking. At no time was there pain, bleeding, discharge or foul odors. His voice assumed a nasal quality, and the escaping fluids annoyed him sufficiently to cause him to seek treatment.

HISTORY — The patient had had measles, mumps and whooping cough. He had had tuberculosis (pulmonary) in 1944, at which time he was hospitalized for three months. He had been sent to a sanatorium for nine months from which he was discharged in 1945 with the condition "arrested."

He had received treatment in 1947 for a detached retina that had resulted from a boxing injury. He had contracted

Fig. 1—Case 1. Oronasal fistula

gonorrhea and syphilis just prior to the present admission. He stated that he received "needles and pills for gonorrhea."

The patient had an inguinal hernia on the right side which was giving him some difficulty; it reduced itself when the patient sat down.

The only surgical procedure reported was a tonsillectomy during childhood. The family history showed the following: his father had died of diabetes; his mother had diabetes at the time of the patient's admission; his sisters were both well; his grandmother had died of tuberculosis.

EXAMINATION—The local and general examinations made Sept. 21 revealed the following: There was a diamond-shaped perforation in the distal portion of the midline of the hard palate; this opening penetrated the soft tissue, bony palate, and mucous membrane of the nasal floor. There was a direct communication with the nasal cavity and the inferior border of the vomer was readily visible as it lay in the middle above the perforation. The edges of the hole were irregular and slightly roughened; there was no bleeding, pain, tenderness or discharge. Oral hygiene was good.

The intraoral occlusal roentgenogram revealed the presence of a radiolucent 1.5 cm. diameter area in the midline of the posterior third of the hard palate (Fig. 1).

The patient was a well developed, well nourished, well proportioned Negro man of about 24 years of age. He was friendly, cooperative, intelligent and in no distress. His head was normal in size and shape; no lacerations, bumps or clefts were evident. Vision was normal in the right eye, but only light and image perception in the left which showed some divergent strabismus. The eye motions were complete and full and media in both eyes were clear. The fundus in the right eye was normal; the fundus in the left eye showed a white and brown scar along the superior arc of the retina. The nose, ears, pharynx and neck were normal; tonsils and adenoids were not present. There was equal expansion in the chest with no lung abnormalities. The heart was not enlarged and was positioned normally; there were no murmurs or pulsations. There were increased breath sounds in the entire left lung posteriorly. The abdomen was slightly obese and moved with respiration. No masses, rigidity or tenderness were present. There was an indirect inguinal hernia on the right side which reduced easily. The liver and spleen were not palpable. The external genitalia were normal except for a hernia in the scrotum.

The impression gained from the examinations were: an oronasal fistula; arrested tuberculosis; strabismus with poor vision and syphilis.

LABORATORY FINDINGS—The roentgenograms made Sept. 21 indicated that the left lung was normal. The heart and trachea were drawn over to the right and there were thickened pleura and fibrosis in the right lung. There was no clear indication of tuberculosis.

The roentgenograms taken Sept. 27 showed no change in the appearance of the lung fields when compared with those taken Sept. 24. Considerably thickened pleura remained that extended downward from the right apex to the base with retraction of the trachea toward the right. There was no evidence of cavitation and nothing suggestive of pulmonary tuberculosis. The left lung and diaphragm were clear. It may be that there was a slight enlargement of the left hilum shadow.

The urinalysis, made Sept. 22, was reported as follows: color, yellow; reaction, acid; specific gravity, 1.026; albumin, negative; sugar, negative; leukocytes, occasional cell per high powered field; crystals, calcium oxalate.

The blood chemistry study of Sept. 22 showed blood sugar, 78 mg. per 100 cc.; blood urea nitrogen, 57 mg.; that of Oct. 20 showed blood sugar, 88 mg.; blood urea nitrogen, 11.

The hematologic examination of Oct. 20 showed hemoglobin, 13.5; white blood cells, 6,250; polymorphonuclear leukocytes, 69; lymphocytes, 31.

The results of the serologic tests of Sept. 22 were negative.

TREATMENT AND COURSE—A biopsy was taken. The patient was started on antibiotic medication and an operation consisting of a palatoplasty was performed in November 1949 with complete closure of the palatal perforation. Eight months postoperatively there had been no recurrence.

DISCUSSION (Dr. Protzel)—Lesions of the oral cavity often present a clinical picture which is not characteristic of a specific disease process. Inasmuch as effective therapy and reliable prognosis depend on the diagnosis, the importance of this clinical phase can be readily understood. The clinician, therefore, must integrate all pertinent aspects concerning the lesion, such as the patient's complaint, history, physical examination, laboratory findings, and biopsy in order to establish a definitive diagnosis. Case 1 illustrates how all this information was utilized to ascertain a precise diagnosis of an unusual oral lesion.

DIFFERENTIAL DIAGNOSIS—The differential diagnosis in this instance should include a wide range of possible lesions, as follows:

Embryonal defects

1. Cleft palate
2. Nonodontogenic cyst

Acquired defect

1. Traumatic defect
2. Nonspecific inflammatory process: (palatal abscess, granuloma or cyst of odontogenic origin that is infected with pyogenic organisms and secondary osteomyelitis)

3. Specific inflammatory or granulomatous process
   a. Tuberculosis
   b. Sarcoidosis
   c. Leprosy
   d. Syphilis
   e. Mycotic process (actinomycosis, blastomycosis, histoplasmosis)
4. Aseptic necrosis of bone, osteosis
5. Metabolic diseases
   a. Diabetes mellitus
   b. Primary histiocytic granuloma (eosinophilic granuloma)
   c. Lipoidosis (Gaucher's disease)
6. Neoplasia
   a. Benign
   b. Malignant (primary, metastatic)

The analysis of the differential diagnosis is as follows:

Embryonal defects

1. Cleft palate. The diagnosis of cleft palate can be eliminated since the palatal defect as established by the history was a recent or acquired one.

2. Nonodontogenic cyst. An embryonic type of cyst with secondary inflammatory changes resulting in osteomyelitis and bone perforation is remote since there was no evidence of pain, swelling, discharge or sepsis. The roentgenogram did not reveal a cyst pattern.

Acquired defects

1. Traumatic defect. Although the history revealed that a "fish bone" had penetrated the palatal mucosa, this type of penetration would not be forceful enough to perforate bone and create the defect noted clinically. It is reasonable to assume, however, that the trauma could have been the exciting factor in initiating a specific inflammatory infection by direct implantation of pathogens or by exposing the lacerated palatal mucosa to invasion by organisms present in the environment.

2. Nonspecific inflammatory process. The development of a radicular abscess, granuloma or cyst associated with a maxillary molar tooth with a subsequent palatal osteomyelitic involvement caused by pyogenic organisms is a remote possibility. The history, oral examination and roentgenograms did not reveal an apical or periodontal pathologic condition associated with the maxillary molars.

3. Specific inflammatory or granulomatous process.

a. Tuberculosis. The past medical history revealed that the patient had an "arrested" case of tuberculosis. On admission, and three weeks later, chest roentgenograms disclosed no clear evidence of tuberculosis; however, this observation does not eliminate the possibility of tuberculous infection since viable tuberculous organisms have been recovered from so-called healed fibrotic or calcified masses. After the primary tuberculous infection, a state of hypersensitivity or allergy develops. In accordance with the Koch phenomenon, reinfection of a tuberculous individual by tubercle bacilli results in a local lesion which forms more rapidly and with greater local inflammatory reaction. Although a tuberculin test was not performed, it is reasonable to assume that, in view of the history, a positive re-

action would result which would indicate a state of hypersensitivity to the tubercle bacillus or the presence of an infectious state. It is highly probable that this palatal lesion represents a secondary or reinfectious process associated with tuberculosis.

In addition, evidence which supported the clinical diagnosis of tuberculosis of the palate was the abnormal urea nitrogen blood level (57 mg. per 100 cc.). The specific gravity of the urine was 1.026 and negative for albumin which is indicative of good kidney function and ability of the renal elements to concentrate in spite of the elevated blood urea nitrogen level. These findings suggest the presence of a long continued infective granulomatous or tissue destructive process such as tuberculosis, which in the formation of secondary amyloid degenerative changes can give the picture of renal disease. It is of special interest to note that the blood urea nitrogen level returned to normal after specific therapy. Clinical diagnosis of tuberculosis of the palate based on clinical and laboratory findings can be established at this point. Biopsy will be necessary to substantiate the clinical diagnosis.

b. Sarcoidosis. Differentiation between sarcoidosis and tuberculosis in any anatomic site is difficult. In contrast to tuberculosis, caseation does not belong to the pathognomonic picture of sarcoidosis. The remarks made previously regarding tuberculosis are also applicable to sarcoidosis; therefore, biopsy section and tissue analysis will be necessary for definitive distinction.

c. Leprosy. Physical examination did not reveal nodular skin lesions characteristic of leprosy, nor did the history disclose the anesthetic form. The diagnosis, therefore, of leprosy is highly improbable.

d. Syphilis. Palatal perforations are noted at times in instances of untreated or inadequately treated syphilis. This type of lesion, however, usually is manifested in late adult life during the tertiary phase of the disease. Invariably, the results of the patient's serologic tests are positive. Inasmuch as this patient is a young adult and there were negative results in the serologic and spinal fluid tests, a diagnosis of syphilitic perforation of the palate cannot be considered likely.

e. Mycotic processes

Actinomycosis. Actinomycotic infection is characterized by a granulomatous reaction with suppuration and discharge of an exudate containing yellowish-green "sulfur granules." The mandible is more commonly involved. In the case under discussion, there was no evidence of suppuration or discharge of the characteristic "sulfur granules," therefore a diagnosis of actinomycosis is highly improbable.

Blastomycosis and histoplas-

mosis. These two are remote possibilities but can be ruled out because of the absence of severe systemic involvement.

4. Aseptic necrosis of bone, osteosis. Osteosis is a collective term which implies aseptic necrosis of bone whether from known or idiopathic causes. Basically, the pathologic process is a noninflammatory degenerative one resulting from physical, chemical or vascular abnormalities. Since the history and physical examination disclosed no evidence of a vascular pathologic condition, thermal or radiation exposure, arsenic, phosphorus or heavy metallic ion ingestion, the diagnosis of aseptic necrosis of the palate can be eliminated.

5. Metabolic diseases and endocrine disturbances.

a. Diabetes mellitus. Since the past medical history did not indicate diabetes mellitus and the laboratory findings revealed a normal blood sugar and no glycosuria, a diagnosis of diabetes mellitus can be eliminated.

b. Primary histiocytic granuloma. A series of diseases believed to be of the same general type are as follows: Letterer-Siwe disease, Hand-Schüller-Christian disease and eosinophilic granuloma. The bones in primary histiocytic granuloma disease are involved by a tumorlike diffuse proliferation of histiocytes.

(1) Eosinophilic granuloma. Since the patient in this instance presented none of the systemic or local signs associated with eosinophilic granuloma, clinical diagnosis of eosinophilic granuloma for this palatal lesion is highly improbable.

c. Lipoidosis (Gaucher's disease). Gaucher's disease with palatal involvement is highly improbable in this case since clinical and laboratory findings do not support evidence of anemia, bleeding or skeletal lesions which would accompany this extensive palatal defect.

6. Neoplasia.

a. Benign tumor. A diagnosis of benign tumor of the palatal lesion in Case 1 is highly improbable since there was no clinical evidence of local growth nor did the past medical history reveal the existence of a slow growing mass so characteristic of a benign tumor.

b. Primary malignant tumor. Primary malignant tumor is unlikely in this patient both because of the very short history and because of the type of surgery performed.

c. Metastatic malignant tumor. Metastatic malignant tumor is fairly well ruled out by the completely negative findings in the general examination, the short history and the type of surgery with its favorable results.

CONCLUSION—After reviewing the various possibilities as outlined in the differential diagnosis, the diagnosis limits itself to an acquired traumatic defect with a specific inflammatory infection, probably tuberculosis.

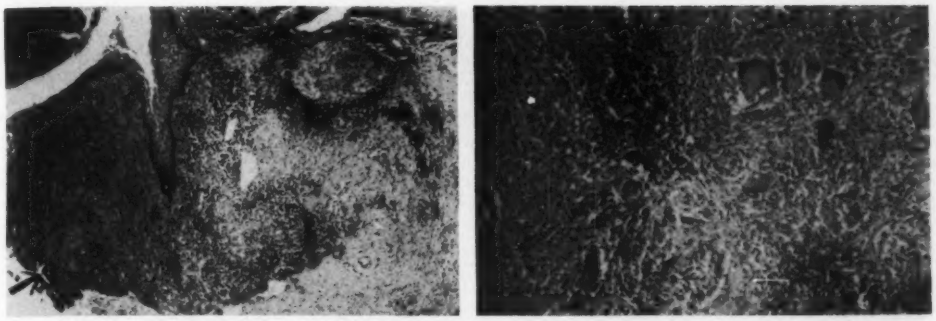

Fig. 2—Case 1. Left: Low-power photograph showing area of tubercle formation. Note Langhans giant cell surrounded by area of necrosis. Right: High-power view showing Langhans giant cells surrounded by areas of necrosis

PATHOLOGIST'S REPORT (Dr. Tiecke)—Microscopic examination showed that the specimen consisted of a fibrous connective tissue stroma which was heavily and diffusely infiltrated by chronic inflammatory elements, chiefly lymphocytes. Numerous epitheloid cells were observed and at least three Langhans' giant cells were seen in this area. The covering stratified squamous epithelium had a prominent basal cell layer and exhibited some vacuolar degeneration but otherwise was within normal limits (Fig. 2).

The diagnosis is tuberculosis of the palate.

■ *Case 2*

The patient was admitted to the hospital with a complaint of a "root in the lower jaw" and "pain." Until five days prior to admission, the patient had been well; at that time he first noted pain in the right side of his mandible while lying on his right side at night. It was a steady pain which came and went and was aggravated by chewing on that side. To the best of his knowledge, he had never had any molars on the right side of his lower jaw, but this had never caused him any concern. Because of the increase in pain, the patient came to the hospital where, after taking roentgenograms of the mandible, he was admitted to the oral surgery service.

HISTORY—There was no history of previous serious illnesses, accidents or injuries. The results of the systemic examination were normal. The patient had worked for two years as a painter and interior decorator. There was no history in the family of tuberculosis, cancer or diabetes.

CLINICAL AND ROENTGENOGRAPHIC EXAMINATION—Clinical examination of the right side of the mandible revealed an enlarged bony region extending from the bicuspid region posteriorly. Eggshell crepitus was noted on careful palpation. The right side of the face was somewhat enlarged. The roentgenographic examination showed numerous multicystlike cavities involving the greater portion of

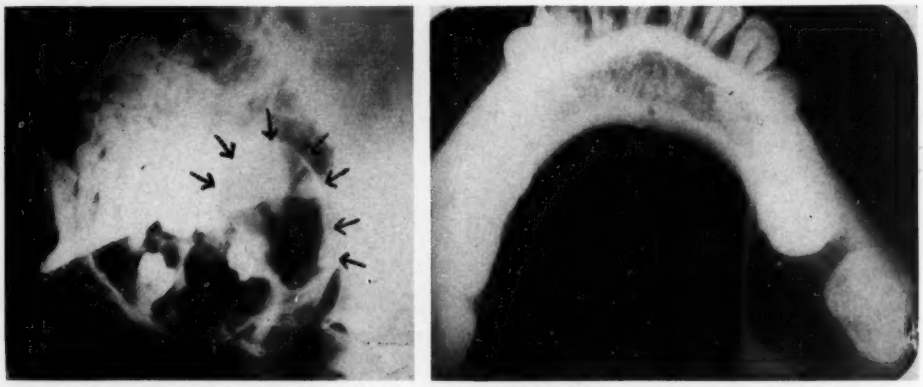

Fig. 3—Case 2. Left: Lateral view of mandible showing multilocular cystic destruction and impacted second and third molars. Right: Occlusal view showing expansion of lingual cortical plate of mandible

the body of the mandible and also a large portion of the ramus. Within these cyst-like regions were two molars. These cysts varied in size from 1 cm. to 4 by 4.5 cm. The walls were smooth and showed considerable expansion of the base (Fig. 3).

GENERAL EXAMINATION—The patient was a well developed and well nourished 20 year old Negro man in no distress and with no gross abnormalities. The temperature was 98.6° F.; pulse rate, 85; respiratory rate, 20; blood pressure, 140/90. No exostoses or evidence of trauma were present in the head. Except for a somewhat enlarged right side, the face was symmetrical. The sclera of the eyes were clear, and the conjunctiva normal. The pupils were round, regular and equal. They reacted to light normally and accommodation was normal. The tongue was normally positioned and was without tremor. The molars were absent on the right side of the mandible and a depressed, non-ulcerated noninflamed region was in their place. Oral hygiene was fairly good. There was no venous distention in the neck, but some scattered lymphadenopathy both anteriorly and posteriorly. The thyroid was normal and the trachea was normally positioned in the midline. The chest was well developed and symmetrical. The heart was not enlarged, the sinus rhythm was normal and there were no murmurs. The lungs were clear to percussion and auscultation. There were no masses, tenderness or rigidity in the abdomen, and peristalsis was normal. The genitalia and the extremities were normal. A rectal examination was not made. The reflexes were physiologically normal; the Babinski reflex was negative.

LABORATORY FINDINGS—The urinalysis was normal. Blood chemistry studies showed blood sugar, 86 mg. per 100 cc.; blood urea nitrogen, 11 mg. The hematologic examination showed hemoglobin, 14.9 Gm.; white blood cells, 5,600; polymorphonuclear leukocytes, 41; lymphocytes, 49; monocytes, 7; eosinophils, 3.

The bleeding time was 1 minute, clotting time, 4 minutes. The results of Kline serologic test were normal. Roentgenographic examination of the heart and lungs showed them to be normal.

TREATMENT AND COURSE — On admittance to the ward, roentgenograms were taken and at that time the views of the right side of the mandible were interpreted as follows: The lateral view showed the presence of two retained teeth on the right side of the mandible, the second and third molars. It was thought that there were two separate cysts present, each arising from its respective molar.

Two days later the patient was brought to surgery and an extensive procedure carried out. The postoperative course was relatively good and the patient was discharged one week later. A two year follow-up has showed no recurrence of disease.

DISCUSSION (Dr. Bloom)—Case 2 is a 20 year old Negro man whose chief complaint was of "a root in the lower jaw" and "pain." The immediate impression is that the problem was relatively acute because the symptoms were only of five days' duration and chewing aggravated the pain. Of interest is the fact that he stated that he had never had his mandibular molars.

His past history, family history, and general physical examination were noncontributory.

Local examination supported the patient's impression that the mandibular molars on the right side had never erupted.

Of great importance is the roentgenographic observation in the right side of the mandible. The indication of numerous multicystlike cavities involving the greater portion of the body of the mandible and the ramus immediately starts a chain of thought in the establishment of a differential diagnosis. The presence of the second and third molars within the cystlike areas starts to narrow the possibilities, of course. In addition, the variation in size of the cysts from 1.0 cm. to 4.0 by 4.5 cm., coupled with the walls being smooth, helps further. The expansion of the base or the inferior border of the mandible and the large eggshell-like appearance of the coronoid process is indicative of a multicystic lesion. The eggshell crepitus further emphasizes the extent of the destruction of both the medullary and cortical bone.

The differential diagnosis includes the cystic diseases of the jaws and is probably limited to (1) multilocular dentigerous cyst or cysts, (2) multilocular cystic ameloblastoma, and (3) multilocular radicular cyst or cysts.

The roentgenographic appearance of the cysts arising from the follicles of the two teeth tends to eliminate the third possibility of multilocular radicular or periodontal cysts. The white blood cell count of 5,600 usually is not compatible with the presence of a severe acute inflammatory process resulting from an infection.

Thus, there are two distinct possibilities; either this patient has benign multilocular dentigerous cysts (plural because of the possibility that these cysts are arising coincidentally from each separate tooth), or a malignant multilocular ameloblastoma. It is not possible to state with

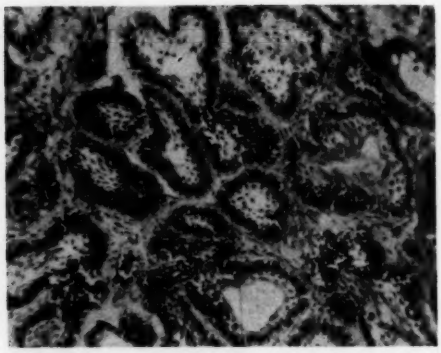

Fig. 4—Case 2. High-power photograph showing ameloblastoma with formation of microcysts

certainty from the roentgenographic appearance which entity is being dealt with. However, from the scalloplike appearance of the cystic destruction and the extensive destruction of the mandible, I would favor the diagnosis of cystic ameloblastoma (adamantinoma). I believe the scattered small palpable cervical lymph nodes are a coincidental finding not uncommon in young people.

In addition the possibility must be considered of two separate entities being present as a chance occurrence. It is possible that the eggshell-like cystic lesion arising from the third molar in the ramus is a dentigerous cyst, and the multicystic lesion associated with the second molar in the body of the mandible is an ameloblastoma. This is a real possibility, but clinically it is rather improbable.

In establishing the final diagnosis of either cystic ameloblastoma or multilocular dentigerous cyst, one must wait on the decision of the pathologist regarding the frozen section at the time of surgery, or even on completion of the paraffin sections.

PATHOLOGIST'S REPORT (Dr. Tiecke)—The sections showed numerous cords and islands of epithelial tissue lying within a dense fibrous connective tissue stroma. These islands were composed of a peripheral layer of deeply staining cuboidal and columnar epithelial cells and an inner latticework of stellate-shaped cells with fine protoplasmic strands. This peripheral zone resembled the ameloblastic layer and the inner zone closely resembled the stellate reticulum of the enamel organ. In the central areas of many of these epithelial structures there appeared to be a degeneration of the stellate reticulum with the formation of hyaline-type material and in some areas of microcystic structures lined by the ameloblastic cells. The ameloblasts were regular in size, shape and chromaticity and presented no evidence of a typical nuclear pattern or mitotic figures (Fig. 4).

The diagnosis is cystic ameloblastoma.

■ *Case* 3

On Dec. 6, 1949, a 77 year old Negro woman came to the clinic with a draining fistula in the mental region of the right side of the mandible. The patient herself was not too coherent, but her niece gave the following history: The patient had had trouble first three years earlier when she went to a dentist who "cut her jawbone." There had been extraoral drainage since that time. Recently the patient had noticed something in her mouth and the "gum seeemed raised on the right side of the jaw." External examination showed a fistulous opening about 0.5 cm. in diameter located on the

inferior border of the right side of the mandible in the mental region. A purulent exudate came through this opening, but little tenderness or swelling was present. Intraorally there was a fistulous opening with purulent drainage in the region of the right mandibular second molar.

HISTORY—The systemic examination indicated the following: The patient had occasional vertigo but no headaches; her sight was poor but she did not have glasses; the ears, throat and neck were normal; she wore an upper denture. There was no history of cardiac disease; she had had pneumonia twice. Her appetite was good and she had no abdominal pain. She was chronically constipated and suffered excessive urination at night and frequent and urgent urination during the day. Menopause had occurred when she was 50 years old, and there had been no bleeding since. There was no history of neurological disease. Recently there had been loss of weight. She denied smoking or imbibing of alcohol.

She had been born in Virginia and had lived in Philadelphia for 20 years. The cause of death of her father and mother was unknown. There was no history of cancer, tuberculosis or diabetes.

LOCAL AND GENERAL EXAMINATIONS—Extraoral examination showed a fistulous opening about 0.5 cm. in diameter located on the inferior border of the right side of the mandible in the mental region, and a purulent exudate came through the opening. It was not tender to palpation and was not swollen. Intraorally there was a fistulous opening in the region of the right mandibular second molar, through which there was purulent drainage.

The patient was an emaciated 77 year old Negro woman in no acute distress. Her blood pressure was 156/90; pulse rate, 80; respiratory rate, 24 and temperature 99°F. The pupils of her eyes reacted to light normally and accommodated themselves normally. The right eye was smaller than the left and she had bilateral cataracts. Her hearing was diminished; she was edentulous; her tonsils were not seen, and there was a draining sinus beneath the right side of the mandible. No lymphadenopathy was present. Her breast was normal and there were no evident thrills or murmurs present in the heart. The lungs were clear to percussion and auscultation. The abdomen was flat and there were no scars; the liver was 1 cm. down. No splenomegaly or masses were present and there was no tenderness; peristalsis was normal. The glands and external genitalia were normal. Her reflexes were physiologically normal. No edema was present in the extremities and there were no deformities. There were hyperpigmented areas on the lower left leg. The impression gained from the examination was arteriosclerotic heart disease with generalized arteriosclerosis; chronic glomerulonephritis and pathologic condition in the right side of the mandible.

LABORATORY FINDINGS—The urinalysis was normal; the results of the Kolmer-Wassermann, Kahn and Kline tests were all negative. The hematologic examination revealed the following: Preoperatively on Dec. 8, the hemoglobin, 9.6; white blood cell count, 5,450; on Dec. 13, hemoglobin, 9.4; white blood cell count,

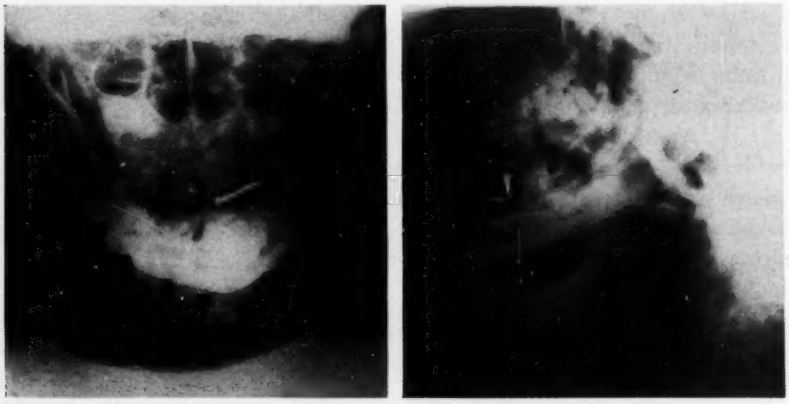

Fig. 5—Case 3. Left: Posteroanterior view showing involvement of mandible by large sclerotic lesion surrounded by radiolucent layer. Right: Lateral view showing sclerotic lesion involving left side of mandible

3,450,000; on Dec. 15, hemoglobin, 10.2; white blood cell count, 4,850. Postoperatively, the examination revealed, on Dec. 20, the hemoglobin, 12.6; white blood cell count, 6,500; red blood cell count, normal; on Jan. 6, 1950, hemoglobin, 11.9; white blood cell count, 5,750; on Jan. 19, hemoglobin, 11.8; white blood cell count, 6,350.

The bacteriological examination of the exudate from the external fistula showed the following: on Dec. 6, the smear showed many pus cells and gram-positive cocci; on Dec. 9, the culture showed *Micrococcus pyogenes* var. *aureus and albus;* on Dec. 10, the culture showed sensitivity to penicillin; no growth was present. The blood chemistry studies Dec. 13 showed total serum protein, 7.9 mg. per 100 cc.; albumen, 3.9 mg., globulin, 4.0 mg.; blood sugar, 79 mg.; blood urea, 29 mg. Preoperative roentgenographic examination on Dec. 8 showed the heart and lungs to be normal; there was an osteolytic process involving the right side of the mandible extending from in front of the angle to the symphysis (Fig. 5). The postoperative examination Jan. 9, 1950, showed complete excision of the irregular bone condensation involving the body of the right side of the mandible. There was no evidence of any active inflammatory process (Fig. 6).

The cardiologist, after examination on Dec. 8, reported: "The electrocardiogram tracing shows nothing except some depression of the S-T segment which we suspect may be the result of digitalis since the patient states that she has been taking medication before entering the hospital. Clinically, the heart is not enlarged and there is no frank failure. While any 77 year old woman is a poor operative risk, we can find no specific contraindications to operation in this instance."

The anesthesiologist reported on Dec. 14, "While the patient is a poor risk for any anesthesia and surgery, I think

she can be given endotracheal anesthesia for a period up to two hours without excessive chance of a poor result. I don't think more than two hours should be planned on. Two units of blood should be available."

TREATMENT AND COURSE—The patient's general status was improved preoperatively after supportive therapy which included multivitamins and whole blood transfusions. On Dec. 16 the operation was performed. Postoperatively the patient did well. The diagnosis was established after examination of the surgical specimen. The patient was discharged on Jan. 23, 1950. One year later there had been no recurrence and the patient was doing well.

DISCUSSION (Dr. Bear)—The history of Case 3 is a bit vague prior to her admission in December 1949 except that she "had had her jaw bone cut" three years previously. After this procedure there had been extraoral drainage through a lesion approximately 0.5 cm. in diameter at the mental region of the mandible. The intraoral complaint was that the "gum was raised" on the right side of the mandible and another area in which there was drainage was noted in the molar region.

With the exception of mild degenerative changes consistent with old age, including arteriosclerosis, the physical examination and history were essentially negative. The presence of arteriosclerosis and the lack of lymphadenopathy should not be overlooked as they may play a part in the final diagnosis. It should also be borne in mind that in the protocol

Fig. 6—Case 3. Postoperative view showing mandible after removal of lesion. Fistula tracts through mandible are evident

considerable emphasis was placed on the fact that the patient needed an operation but was not a particularly good surgical risk.

The patient's recent loss of weight should not be ignored as it may be some indication of a systemic problem, but more than likely is associated with the oral lesion.

The lesion is obviously infected as demonstrated by positive cultures taken from both extraoral and intraoral points of drainage. It can also be assumed that the problem is somewhat chronic in character as it had been present for over three years without producing any acute symptoms.

There is one point of controversy contained in the protocol which caused some confusion as to the type of mandibular lesion actually present:

1. The preoperative film indicated that there was an osteolytic process involving the right side of the mandible extend-

ing from in front of the angle to the symphysis.

2. The postoperative film indicated that there was complete excision of the irregular bone condensation involving the right side of the mandible.

These two reports appear to be contradictory since the preoperative film showed an area of bone destruction and the postoperative film indicated that an area of condensed bone was excised. What, then, are we to do? Should one report be eliminated as describing the lesion incorrectly and discuss the other type of lesion? If this is done, which should be discarded?

Would it not be wiser to look for a disease process which contains both osteoblastic and osteoclastic elements? It would seem logical to accept this latter approach and assume the protocol is correct though entirely too vague.

I think all of the more commonly found cysts associated with the mandible which occasionally produce regions of dense bone at the periphery of the cyst can be discarded. The primary reason for not discussing the cystic lesion as a possibility is the method of treatment—with a patient who is a poor risk, conservative measures certainly would be utilized so as to avoid a general anesthetic which might risk the patient's life.

Next such lesions as eosinophilic granulomas and those resulting from hyperparathyroidism, and osteomalacia associated with vitamin D deficiency can be considered. Since these lesions often are multiple, occur at an early age and are purely osteolytic without evidence of a condensing process, they may be eliminated.

The possibility of malignant lesions cannot be overlooked in anyone this age and where bone destruction is evident. However, neither can the fact be ignored that this lesion has existed for at least three years with no acute symptoms except chronic drainage. A carcinoma, whether primary or secondary, or a sarcoma, would produce sufficient symptoms to warrant treatment before three years had elapsed. In addition there was no noticeable lymphadenopathy. With rare exceptions, osteosclerosis is not associated with malignant disease. Still another clinical fact cannot be overlooked—the patient had had extraoral drainage for a three year period, yet upon examination there was little tenderness or swelling in the region. A malignant lesion undoubtedly would have invaded the soft tissue sufficiently to cause swelling and probably pain.

The chondromas can be discarded as a possibility on the basis that the mandible was not visibly enlarged; the patient was somewhat too old for the disease, and with the exception of the osteochondromas, they are radiolucent.

One lesion of a benign nature which tends to produce both osteolytic and osteoblastic areas is the osteoid osteoma. However, the disease entity is more frequently found in the male than in the female and at a younger age. More specifically, it does not grow to such proportions as described in this case and in addition there usally is considerable pain.

Lesions of the vascular or nerve tissue should be considered briefly as they are osteolytic in character and can produce a sclerotic border. However, there would be expansion of the cortical bone which is not suggested in this instance

and a biopsy probably would have been taken before extensive surgical intervention.

Since there is no mention of a biopsy, it must be assumed that surgical intervention was necessary, and it was also stated that the diagnosis was made from the surgical specimen. Having determined that surgery was necessary and having eliminated the malignant, cystic and reparative type of diseases, only a few possibilities are left. Assuming that the protocol is correct in stating that an osteolytic lesion existed in a region of condensation, the remaining possibilities must meet this criterion.

Some types of ameloblastomas may fit these requirements. The lesion is extensive, along the entire body of the right side of the mandible. A tentative diagnosis could be made on the basis of roentgenographic observations which had made surgical intervention acceptable. A slow-growing ameloblastoma may have regions of osteosclerosis associated at its border and the lesion need not produce painful symptoms.

Several things, however, do not fit an ameloblastoma:

1. The patient was "cut on" three years previously and yet no swelling was present until a short time before hospitalization.

2. There was no appreciable swelling which would almost certainly have occurred had it been an ameloblastoma.

3. Though there was extraoral drainage, no appreciable deformity was visible.

4. The mandible per se showed no evidence of expansion. A long-standing ameloblastoma would have; this would be particularly true after the lesion had been invaded.

Monostotic Paget's disease must be considered since, with this condition, there are regions of osteosclerosis and osteoporosis. The age of the patient is compatible with the lesion, though at this age the sclerotic bone should be more evident. Paget's disease often is associated with arteriosclerosis which was found in this patient and there may be renal disease which also is suggested on the basis of the albumin-globulin ratio. However, the mandible is not visibly enlarged which one would expect at this age; no results of the blood chemistry examinations are given which would be important since the alkaline phosphatase would be considerably elevated; and one would expect to find the roentgenographic report placing more emphasis on the sclerotic findings than on the osteolytic process. Finally, monostotic Paget's disease is relatively rare, and even more rarely found in the mandible.

Fibrous dysplasia is a rather broad term including the ossifying fibroma, fibro-osteoma, osteoma and cementoma. I shall not try to make any differential diagnosis as far as the specific type of fibrous dysplasia except to say that on the basis of age, one would assume the lesion would be more on the osteoma side of the range of possibilities.

A lesion somewhat similar in character in that there is sclerosis but generally minimal destruction is condensing osteitis. The increased bone density is diffuse in nature and may be associated with a subclinical osteomyelitis. These regions generally are small and most typically arise in the jaws in association with periodontal

or periapical disease and persist without much change unless they become infected. It is not uncommon to find an elderly person with regions of condensing osteitis experiencing a breakdown and infection in the regions of sclerosis. This is seen more frequently in the female and in the Negro.

The distinct possibility of chronic sclerotic osteomyelitis must not be overlooked. This clinical entity would explain the regions of condensation and the osteolytic process is explained on the basis of chromic destruction persisting over a three year period. Long-standing osteomyelitis would produce chronic fistula either intraorally or extraorally or both. Subsequent subacute breakdown will account for the soft tissue swelling that was seen intraorally.

The possibility of tuberculosis and actinomycosis can be discarded on the basis of the bacterial studies. In addition, there was no severe pain which would be associated with tuberculosis and the soft tissues were not sufficiently involved to warrant the consideration of actinomycosis and the bacteriology smear showed no sulfur granules.

In conclusion, here is an elderly Negro woman with an osteolytic lesion of the mandible associated with an area of bone condensation. There was obvious chronic osteitis confirmed by the chronic drainage found both intraorally and extraorally. The process apparently became somewhat acute which would account for the recent intraoral swelling. The organisms involved are those commonly found in the oral cavity and the eventual resistance built up against penicillin is a common observation.

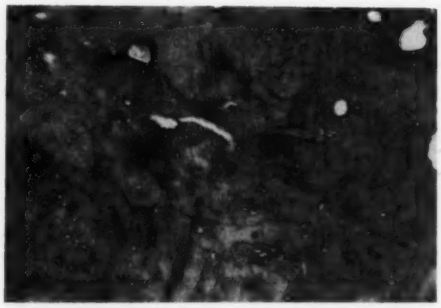

Fig. 7—Case 3. High-power view showing calcification with lacunae present both with and without cellular content

Therefore, I would make the diagnosis of a region of osteosclerosis which might be the result of condensing osteitis or a calcified area of fibrous dysplasia on which is superimposed an extensive osteolytic process of chronic osteomyelitis.

PATHOLOGIST'S REPORT (Dr. Tiecke)—The specimen consisted of calcified material in which numerous oval lacunae were observed. Very few cementocytes were seen, however, and most of the lacunae appeared to be empty. There is considerable irregularity of the incremental growth lines. Haversian systems and Volkman canals were missing (Fig. 7).

The diagnosis is cementoma.

(Several pathologists made the diagnosis of sclerosing osteomyelitis.)—*40 Maple Street.*

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*Oral surgeon, cancer division, Westfield State Sanatorium; departments of oral surgery and oral pathology, Tufts University School of Dental Medicine, Boston.

†Professor of pathology, Northwestern University Dental School.

‡Assistant professor of pathology, New York University School of Dentistry.

§Mount Carmel Mercy Hospital and Sinai Hospital, Detroit; faculty, University of Michigan Dental School, Ann Arbor, Mich.

‖Assistant professor, department of oral surgery, Medical College of Virginia; consultant, U. S. Naval Hospital, Portsmouth, Va.

Value of the twelve hour disk sensitivity test in the management of infections of the face, neck and oral cavity

■ *Tyler C. Folsom, Jr.,* D.D.S., M.S.D., San Francisco, and Orion H. Stuteville,† D.D.S., M.S.D., M.D., Chicago*

The emergence of more resistant strains of streptococcus and staphylococcus emphasizes the necessity for developing a more rapid method of evaluating antibiotic sensitivity. Valuable time is lost and effective treatment is delayed when the tube dilution method is employed. A 12 hour disk sensitivity test is evaluated and determined to be dependable and accurate.

The ability of pathogenic organisms to develop resistance to antibiotics had been long suspected and is now well-known; for example, resistance of organisms to streptomycin is developed rapidly and rather completely. Miller and Sherlock-Hubbard,[1] in a study from 1945 through 1951, found that resistance of pathogenic staphylococci (*Micrococcus pyogenes*) to penicillin had shown considerable increase during this period. They also noted the development of resistance, by usually sensitive organisms, to the broad-spectrum antibiotics during the last two years of their investigation.

Bondi and co-workers[2] found that the most commonly resistant strain of *Micrococcus pyogenes* encountered in their study was resistant to penicillin, streptomycin, chlortetracycline and oxytetracycline. In their survey of the antibiotic sensitivity of 125 recently isolated strains of *Micrococcus pyogenes*, it was indicated that the percentage of resistant strains was increasing. The widespread misuse and abuse of the antibiotics, together with the increasing incidence of resistant strains of microorganisms, has become the concern of many authors, including Stuteville[3] and Pulaski.[4] More and more often these authors have encountered serious infective processes which do not respond favorably to the formerly effective agent employed. In such instances, the clinician must determine rapidly the most effective drug to use in overcoming the infection. If treatment is not effective against the organism, there is danger of possible sensitization of the patient to an antibiotic or other therapeutic agent which may be required at some future time.

The literature contains an increasing number of references to the occurrence of sensitivity of the patient to commonly used drugs, particularly penicillin. In fact, this has become so common as to necessitate obtaining a brief history of allergy—with direct reference to penicillin—while examining a patient, and to observe him very closely during the course of therapy to detect any early signs of developing sensitivity to the agent in use. It is also possible to increase the resistance of the microorganisms to these materials if ineffective dosages are used in treatment. This latter consideration, in turn, poses additional problems in relation to the public health aspects of the unwelcome phenomenon. Among hospital personnel there is an increasing number of people who serve as "carriers" for these resistant strains of microorganisms.

Because of the large number of antibiotic and chemotherapeutic agents for treatment of infectious processes, it must be predicated that the intelligent use of these materials should be based on their activity against the microorganism in question. Many methods of determining the susceptibility of microorganisms to inhibitory agents are in the literature. Of these, the tube dilution test is considered the most accurate, but it is a slow, expensive method which does not lend itself to universal use, especially in small laboratories or the smaller hospitals.

The disk method has been shown by many investigators, including O'Toole,[5] Fusillo and Kuhns,[6] Lind and Swanton,[7] Morley,[8] Bondi and co-workers,[9] Spaulding and Anderson,[10] and Lynch,[11] to be an effective, easily conducted test which is readily applicable to even the smallest laboratory, and affords a rapid way of making the choice of the most effective therapeutic agent for treatment of the patient.

Lind and Swanton[7] stated:

> Normally when a specimen of body fluid is submitted for culture and isolation of microorganisms, a request may or may not be made for sensitivity against a particular antibiotic. On isolation of the micro-organism, the conscientious bacteriologist will attempt to ascertain from the pathologist, physician, or consultant, whether a sensitivity test should be run, and if so, against which antibiotics. In this period of indecision there may be a delay of from several hours to several days.

Another factor which affects the rapidity with which results of a sensitivity test are obtained is the practice of completely identifying the organism(s) in the specimen and then using the pure cultures for subculture in sensitivity tests. In many instances this information is obtained at a time when clinical improvement is already apparent or the condition of the patient is such that heroic measures must be used to treat him. For these and other reasons it is necessary to use a method which will give accurate results in a minimal period of time and which is suitable for routine diagnostic work.

Spaulding and Anderson[10] made the following statement:

> It is impossible in many instances to select the proper antibiotic on the basis of the nature of the infection. . . . Even though the identity [of the organism] may be known, it is not always possible to say that penicillin or some other antibiotic is the one of choice. It is true that certain delicate bacterial types are highly susceptible to most chemotherapeutic drugs. Group A hemolytic streptococci, pneumococci, and gonococci are examples.

Fairbrother, Martyn and Parker[12] also have recognized that the identification of the microorganism is not sufficient basis for the rational treatment of these infections. They stated that "sensitivity tests usually require at least twenty-four hours before a satisfactory result can be reported."

One of us (O.H.S.) has often expressed the need for a rapid evaluation of the antibiotics by sensitivity testing in oral infections and has stressed the value of a 12 hour test from a clinical standpoint. He is of the opinion that the long delay often encountered by the clinician in securing sensitivity reports from the laboratory encourages the so-called "shotgun" treatment.

Many investigators have pointed out that the results obtained with sensitivity disks, as with other sensitivity tests similarly employed, are of a qualitative rather than a quantitative nature. The many variables that enter into a test of this type, such as the size of the inoculum, amount of the inoculum on the plate, type of growth of the organism, thickness of the medium, incubation conditions, diffusion rate of the therapeutic agent, and the rate of deterioration of the therapeutic agent during incubation all contribute to its qualitative rather than its quantitative nature.

The investigation by Lynch[11] in evaluation of the disk sensitivity method of testing the susceptibility of bacteria in infections of dental origin to antimicrobial agents showed that this method is a valid one, that it closely parallels the results obtained by the longer, more tedious method of testing susceptibility by means of the tube dilution method, and also showed that results of these tests could be determined after a 12 hour testing procedure. By this method the more effective antibacterial agents could be determined, as well as revealing which drugs were ineffective in a given instance.

■ *Statement of the Problem*

This investigation was undertaken to evaluate the laboratory technic of testing the microbial agent of an infectious process against the treatment of the patient with the antibiotic or other therapeutic agent of choice, as determined by the 12 hour disk sensitivity method, with particular attention given to the course of the infection during the period of treatment.

■ *Materials and Methods*

One hundred and nine patients were selected from the oral surgery department of Northwestern University Dental School, the oral surgery service of Cook County Hospital, the surgical service of the U. S. Public Health Service Hospital (Chicago), and from two private practices.

The ages of the patients in this study ranged from 13 months to 85 years old. There were six children between the ages of two and a half years and nine. Eight patients were between the ages of 62 and 85. Ninety-five of the patients observed in this investigation were between the ages of 19 and 45. There were 48 females and 61 males in this series.

The diagnoses of the patients in this series included infections in the fascial spaces, such as buccal, submaxillary, pterygomandibular, submasseteric, vestibular and pan-facial space infections, and

one instance of pan-cervical space infection—all of odontogenic etiology. The following conditions were also included: osteomyelitis; infection after bone graft to the mandible; infected adamantinoma; infection after fracture of the mandible; infection of subcutaneous space from insect bites and trauma; Ludwig's angina after injury to the floor of the mouth; sialadenitis of the parotid gland after mumps and obstruction of Stensen's duct; acute infection of the tongue after epileptic seizure; nonspecific ulcerous stomatitis; pharyngitis, and ear infections.

In general, patients who sought treatment for dentoalveolar and facial abscesses resulting from odontogenic or other oral infections afforded the best subjects for collection of uncontaminated specimens, although specimens were also collected from other sources of infection, as listed previously. In each instance, a short history was taken, with special attention given to the diagnosis and previous antibiotic therapy.

Patients who had had antibiotic therapy within a week prior to their appearance for treatment were not included in this study. A few exceptions to this were made later in the investigation in order to evaluate the effect of adding penicillinase to the fluid thioglycollate broth medium in which all the specimens were collected. The exclusion of patients who had received penicillin therapy previously was done to avoid the phenomenon known as masking, whereby the reaction of microorganisms to various antibiotics is altered or suppressed.

Extraoral or intraoral aspiration using Vim Vial glass syringes or a Luer-Lok glass syringe, 2 or 5 cc. in capacity, with a 16-gauge B-D Yale hypodermic needle was used in each instance. All the syringes and needles employed were sterilized, in paper syringe envelopes, by autoclaving 15 minutes at 20 pounds pressure. In extraoral aspiration, the area of the puncture was given a soap and water scrub for five minutes, followed by application of 1:1,000 solution of tincture of benzalkonium chloride. The same procedure was followed in intraoral aspiration except for the soap and water scrub. In addition, careful isolation of the field with sterile 2 by 2 inch gauze sponges was accomplished in all the intraoral procedures. The material obtained by aspiration was then introduced, with aseptic technic, from the syringe into a sterile test tube containing 10 cc. of fluid thioglycollate broth medium immediately after its collection. This medium was employed because it adequately accommodates the growth of anaerobic microorganisms as well as aerobic microorganisms. After the material was collected, the patient was released for treatment. Obviously contaminated specimens were discarded.

Treatment generally consisted of penicillin therapy, and incision and drainage with extraction of the offending tooth, as indicated; adequate surgery without antibiotic therapy was also employed. A certain number of patients were continued on this usual, or routine, method of treatment while others were put on the drug of choice as indicated by the results of the disk sensitivity test, reported 12 hours after incubation of the specimen.

The antibiotics studied in this investigation are listed in Table 1. Only the medium concentrations of the disks were

used, because this concentration is believed to approach more nearly the clinical concentration achieved and maintained in the blood stream than do the other concentrations.[9]

The disk sensitivity test was performed in the following manner:

1. Five drops of the specimen from the fluid thioglycollate broth tube were deposited on each of two sets of four 90 mm. blood agar plates and two plates of Mueller-Hinton medium from a sterile transfer pipet. The latter medium was used for the sulfonamide drugs.[13]

2. A sterile right angle glass rod was used to spread the inoculum evenly over the surface of the agar plates in order to obtain confluent growth.

3. The sensitivity disks, which were obtained in sterile vials, were kept in a refrigerator until used, to protect the potency of the drugs. Sterile thumb forceps (college pliers) were employed to place these disks upon the agar surfaces. No attempt was made to place the antibiotic disks in any certain combination, except for those containing the sulfonamides. These disks were placed on the Mueller-Hinton medium; the remainder on the blood agar medium. Four of the disks were placed on each of the first three blood agar plates and three disks on the fourth blood agar plate. A duplicate set of plates for anaerobic incubation was prepared in the same manner. An anaerobic atmosphere was obtained by use of a Brewer jar into which hydrogen was admitted under 3 to 5 atmospheres of pressure, in the presence of a platinum catalyst.

4. In addition, a blood agar plate was streaked with the specimen from the fluid thioglycollate broth tube by means of a flamed platinum wire loop and incubated at 37°C. until growth developed. This was done for the purpose of separating the colonies and classifying the organisms according to hemolysis. Once a colony or colonies of microorganisms were isolated, routine bacteriologic procedures were employed in order to identify the organism.

Table 1 • Drugs employed, with concentration and identification of each

Therapeutic agent	Color	Shape	Concentration
Bacitracin	Brown	Round	10 units
Carbomycin	Magenta	Round	5 μg.
Chloramphenicol	Gray	Round	30 μg.
Chlortetracycline	Yellow	Round	10 μg.
Dihydrostreptomycin	Pink	Round	10 μg.
Erythromycin	Red	Round	5 μg.
Nitrofurantoin	Brown	Square	50 μg.
Neomycin	Chartreuse	Round	10 μg.
Oxytetracycline	Terra cotta	Round	10 μg.
Penicillin	Green	Round	5 units
Polymyxin B	Blue	Round	10 μg.
Tetracycline	Orange	Round	10 μg.
Viomycin	White	Round	10 μg.
Sulfadiazine	Pink	Square	150 μg.
Sulfisoxazole	White	Square	150 μg.
Triple sulfonamide preparation (sulfadiazine, sulfamethazine, sulfamerazine)	Orange	Square	150 μg.
Isonicotinylhydrazine	Green	Square	10 μg.
Para-aminosalicylic acid	Gray	Square	10 μg.

5. One set of plates was incubated under aerobic conditions and the other set under anaerobic conditions at 37°C. for 12 hours.

6. After incubation for 12 hours, or until growth developed, the diameters of the zones of inhibition were measured with a metric rule and recorded to the nearest millimeter.

7. When the history elicited previous therapy with penicillin, as occurred

in six instances, the specimens were collected in fluid thioglycollate broth to which penicillinase had been added. In these instances, satisfactory, measurable growth was obtained. In similar situations, when the history subsequently proved to have been inaccurate with regard to the patient's not having had penicillin, no growth was obtained from the specimens collected in plain fluid thioglycollate broth.

The response of the patients to the treatment which they received was based on the following criteria: relief from pain, resolution of edema, return to normal temperature, cessation of drainage, return of function, and the amount of time required for these objectives to be attained.

The intervals of time for improvement were chosen arbitrarily prior to analysis of the data collected. This was done in order to record the results obtained by the most objective methods applicable to a study of this type. These intervals of time represent, respectively, rapid recovery, good recovery and delayed recovery. It is felt that the most desirable progress should be obtained in as short a time as possible, within biologic limits, and for this reason, the time interval of one to six days was selected as a base line. At the other end of the curve, instances in which more than 11 days were required to obtain these criteria were classified as displaying delayed healing, and the infectious process was considered to be approaching a chronic state. A third interval of time was selected and arbitrarily considered to be a clinically acceptable length of time for healing to have occurred—seven to ten days.

No one individual consistently followed the progress of all of the patients involved in this study. There were four additional persons, each of whom was completing graduate study and training in the specialty of oral surgery, who recorded their impressions and evaluation of the rate of progress of each of the patients observed in this investigation. Frequently, one patient was seen on subsequent visits by a different observer each visit. The data contained in this paper were compiled from the chart of each patient after completion of his treatment.

■ *Results*

Specimens from 12 of the 109 patients studied showed no growth on the media. These specimens and the patients from whom they were obtained were deleted from the study. Six of the remaining 97 patients were lost to follow-up observation because of unavoidable circumstances; as a result, 91 patients remained for inclusion in the study. In addition to these 91 specimens and patients, six specimens showed good growth, were identified, and the response of these cultures to the antibiotics in vitro were recorded and are included in the analysis of the laboratory data.

The drug of choice was selected according to the size of the zone of inhibition around the disks; Bondi and co-workers[9] have stated that zones of inhibition greater than 20 mm. in diameter indicate that susceptibility to the drug is very great, zones 10 to 20 mm. indicate moderate susceptibility, and zones less than 10 mm. indicate resistance to the drug. The effectiveness of the agents employed in this study was interpreted in this manner.

Of all drugs included in this study, the only ones which produced consistently good zones of inhibition were chloramphenicol, erythromycin, and nitrofurantoin. In other instances, there was a rather wide variation of effectiveness among the tetracycline compounds, as a group, as well as in comparison to the other drugs in the series. The sulfonamide compounds produced disappointing results in general, being effective in only a small number of instances, and in these instances there was usually a drug or two which gave larger zones of inhibition.

It is not surprising that neomycin sulfate, isonicotinylhydrazine and para-aminosalicylic acid gave as poor a showing as they did because of the nature of the organisms encountered in this investigation. This is a confirmation of the findings observed by Lynch[11] in his study.

In some instances, nearly all the drugs used showed a very high degree of inhibition. When this occurred, the drug of choice was usually penicillin, which was selected on the basis of its low incidence of toxic side-effects, ease of availability, and economy. When two or more drugs showed good inhibitory power, the least toxic of the agents was selected; thus, when chloramphenicol was clearly the drug of choice by virtue of the size of the zone of inhibition around its disk, another agent was reported as the drug of choice even though the zone of inhibition around the disk of the latter agent was of slightly smaller diameter.

There were 38 instances in which the microorganism or microorganisms were resistant to penicillin. These cultures were both mixed (53 per cent) and pure (47 per cent). Of these 38 instances, strains of streptococci were isolated in 29 instances (76 per cent). Of the 18 pure cultures, 12 were composed of one or another strain of streptococcus, whereas in 3 instances, pure cultures of *Micrococcus pyogenes* of one or another variant were produced. The three remaining cultures were of coliform bacillus.

The remaining 20 (53 per cent) cultures in this group were mixed cultures and contained two or more of the previously mentioned types of microorganisms, as well as others such as anaerobic *Micrococcus pyogenes*, var. *aureus*, anaerobic alpha streptococcus, *Proteus vulgaris*, and *Micrococcus citreus*. It is of interest to note that 39 per cent of all the cultures in this study were found to be resistant to penicillin in the concentration of the drug against which they were tested (Table 2).

Fifty-five of the cultures grown contained only one microorganism (56 per cent); 30 had two microorganisms (30.9 per cent); ten had three microorganisms (10.3 per cent); one had four microorganisms (1 per cent); and one had five microorganisms (1 per cent).

Ninety-seven of the specimens produced good growth. Of this number of cultures, 93 (96 per cent) grew equally well in aerobic or anaerobic atmospheres; 2 (2 per cent) were anaerobic in nature, whereas 2 (2 per cent) were aerobic in character.

The response of the patient to treatment is related to the diagnosis, whether or not he received the drug of choice, the type of treatment he was given, and the clinical course he followed during and throughout therapy. The clinical course is based on observable improvement, both

Table 2 • Susceptibility of microorganisms

Drug	Percentage of cultures			
	Microorganisms very susceptible*	Microorganisms moderately susceptible†	Microorganisms resistant‡	Total effectiveness of drug (sum of column 1 and 2)
Chloramphenicol	82	14	4	96
Erythromycin	73	20	7	93
Chlortetracycline	48	44	8	92
Tetracycline	55	36	9	91
Oxytetracycline	25	65	10	90
Bacitracin	25	63	12	88
Nitrofurantoin	38	50	12	88
Carbomycin	36	49	15	85
Dihydrostreptomycin	15	56	29	71
Penicillin	36	25	39	61
Sulfisoxazole	24	12	64	36
Triple sulfonamide preparation	12	24	64	36
Sulfadiazine	10	19	71	29
Neomycin	5	18	77	23
Polymyxin B	0	10	90	10
Viomycin	1	7	99	8
Isonicotinylhydrazine	0	1	99	1
Para-aminosalicylic acid	0	1	99	1

*Zones of inhibition measuring more than 21 mm. in diameter.
†Zones of inhibition measuring 10-20 mm. in diameter.
‡Zones of inhibition measuring less than 10 mm. in diameter.

subjectively and objectively, and the time required for this improvement to occur.

In 51 patients the treatment consisted of routine therapy. Twenty-six (51 per cent) achieved improvement in six days or less; 16 (31.4 per cent) achieved improvement in seven to ten days, whereas 9 (17.6 per cent) required 11 days or more for satisfactory cessation of symptoms.

Forty patients were treated on the basis of the results of the 12 hour disk sensitivity test, with 27 (67.5 per cent) obtaining improvement in six days or less; 9 (23 per cent) of them achieving improvement in seven to ten days, and 4 (9.5 per cent) requiring more than 11 days for healing and recovery.

The application of statistical methods to these figures produces a chi square of 0.36.

■ *Discussion*

The value of a 12 hour sensitivity test is obvious to the clinician who now must wait for days in order to obtain this same information from tests carried out in the routine manner employed by most laboratories in our hospitals. The accuracy of this method of testing microbial susceptibility to various therapeutic agents is well established,[2, 5-7, 9-11, 14] together with its ease of performance and the minimal amount of equipment required.

In addition to determining which of the drugs was most effective, equally important information was obtained in regard to which drugs were not effective.

This sort of negative information is also of great clinical value, as the use of an ineffective agent entails the serious risk of sensitizing the patient to a drug which might otherwise be life saving at some future date.

An observation that was especially interesting was the number of instances in which the organisms were unaffected by the presence of penicillin. Various figures have been given concerning the incidence of resistant microorganisms, but none have been so high as that met with in this study, particularly when it is considered that many of these microorganisms were streptococci. It is generally recognized that strains of micrococcus are able to develop resistance with some facility, but many authors have believed that resistance of strains of streptococcus to antibiotic drugs does not occur. The findings in this study are at considerable variance with this opinion.

Most of the patients in this study received therapy which also included adequate surgical procedures in conjunction with penicillin administration in addition to those who received the drug of choice. In other instances, the only treatment was removal of the source of infection, with noticeable improvement occurring within a short time, comparable to some of the better results obtained from administration of therapeutic agents in addition to surgery.

More than 25 (68 per cent) of 37 patients who received adequate surgery with no medication except anodynes showed improvement in one to six days. Five of the remaining patients (14 per cent) in this group obtained improvement in periods up to 20 days; the other seven patients (18 per cent) showed improvement in the seven to ten day period.

Eighteen patients received the drug of choice and no surgery. In this latter group, 13 patients (72 per cent) obtained improvement in one to six days, 3 (17 per cent) in seven to ten days, and 2 (11 per cent) in 11 days or more.

This observation confirms the opinion of many eminent clinicians who have observed from their experience that the use of antibiotics or chemotherapeutic agents does not replace good surgical measures. It is also apparent that the careful selection of therapeutic agents enhances the clinical progress of the patient. Indeed, the inference may be drawn that the promiscuous or improper selection of therapeutic agents interferes with normal healing processes.

Since the patients in this study received the benefit of both surgery and antibiotic therapy, both groups of patients are as comparable as is possible in a study of this nature.

The dosage of the therapeutic agents used in this study depended on the age of the individual and the severity of the infection. The duration of administration of drugs was usually 48 to 72 hours after the patient became afebrile. This event was accompanied by resolution of edema, comfort and return to function. Twelve patients required medication with antibiotics or chemotherapeutic agents for periods ranging from two to five weeks.

The route of administration depended on the drug given. Penicillin was usually given intramuscularly, though it was occasionally employed in its oral form, whereas the broad-spectrum antibiotics and the sulfa drugs were given orally.

■ *Summary and Conclusions*

The value of the 12 hour disk bacterial susceptibility test is apparent. The importance of a rapid, accurate method of determining the susceptibility of microorganisms to antibiotic and chemotherapeutic agents was never so great as at the present time when so many resistant strains of *Micrococcus pyogenes* and even of streptococci are being encountered at frequent intervals. A further complication is the presence of the occasional microorganism, such as the coliform bacillus, removed from its natural environment where it is harmless, to another location where it is capable of pathogenic activity. This microorganism generally is not susceptible to the drugs which control the usual infections in these locations. Of almost equal value is the information concerning which agents are not effective in this and other instances.

The accuracy of this method of testing for susceptibility, together with its ease of accomplishment, has been established by many investigators. The test can be set up at the end of the working day in which the specimen is received, the plates allowed to incubate overnight, and the results can be read and reported early the following day. Identification of the microorganism, which is largely of academic and statistical importance only, can be done later with no adverse effect on the clinical course of the patient.

An analysis of the data obtained in this investigation leads to the following conclusions:

1. Use of the 12 hour disk susceptibility test against several drugs in terms of a specific infectious process resulted in a significantly greater percentage of patients achieving cure in a shorter period.

2. The most commonly encountered etiologic agent in infections seen in this study includes strains of streptococcus and variants of *Micrococcus pyogenes,* a confirmation of other studies.

3. The incidence of isolation of resistant strains of microorganisms is somewhat greater than indicated in previous reports, but follows the general trend observed in other studies.

4. The isolation, in 29 instances, of penicillin-resistant strains of streptococci, including beta-hemolytic strains, is at considerable variance with some of the impressions contained in the literature.

5. The observation of rapid improvement in those patients who received adequate surgery without concurrent medication is an important one. This confirms an opinion which was not previously justified by scientific methods.

6. The 12 hour disk sensitivity test is easily performed with a minimal amount of equipment and thus is readily adaptable for use in even the smallest laboratory.

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*Senior dental surgeon, U. S. Public Health Service, U. S. Public Health Service Hospital.

†Professor of maxillo-facial surgery, Northwestern University Dental School.

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Experimental investigation into the healing of extraction wounds in macacus rhesus monkeys

■ *Harold E. Simpson,* M.D.S., Newcastle upon Tyne, England*

Consecutive histologic examination of post-extraction sockets in monkeys was performed to study the normal healing processes. Being primates, monkeys provide an excellent source of material for a study of this type. Epithelization required one to two weeks and bone healing of the sockets reached a fairly stable condition at the end of eight weeks. Although the labial plate showed consistent evidence of resorption, the lingual plate was altered very little.

Investigations into the healing of tooth extraction wounds have been carried out sporadically for many years, and a considerable amount of information has been amassed on various aspects of this subject. Most of the reports, however, have been of clinical investigations, and the vast majority have been concerned with the prevention and treatment of dry socket. In the last 20 years there have been over a hundred articles published on this condition in the British and American dental literature. Technical articles concerning tooth extraction (such as Rounds')[1] have described thoroughly the mechanics of tooth removal, but histological descriptions of the ensuing healing processes are relatively few.

Euler[2] (1923) described the healing of normal extraction wounds in dogs, supplementing his histological investigations with roentgenograms. Szabo carried out similar experiments in 1927,[3] and in 1928[4] investigated the effects of retained roots on the course of healing. Spitzer[5] (1924) reviewed the available knowledge of the course of the healing processes, and briefly described the effects of suturing and packing. He stressed the importance of a sound extraction technic. Meyer[6]

(1924) carried out experiments on healing under abnormal conditions, investigating the effects of suturing, packing, trimming of the gingival margins, and the insertion of foreign bodies in the socket.

In 1941 Mangos,[7] using biopsy and autopsy material, reported on the healing of human sockets. One result of this investigation was the establishment of some degree of comparative chronology, since he found that healing of the epithelium and submucosa took twice as long in man as in dogs, and bony repair three times as long. However, there are considerable differences in the times required for the epithelization of dog sockets reported by different investigators. Glickman and co-workers[8] (1947) investigated the effects of retained root remnants in albino rats and found that whereas remnants deep in the wound were well tolerated, those near the surface caused inflammation and interference with epithelial continuity. Huebsch and co-workers[9] (1952) described the healing of normal extraction wounds in rats; he found that the healing processes were somewhat more rapid than in dogs.

The present experiments were carried out in order to increase the available information on the healing of extraction wounds in primates, a subject which has received little attention. The simple forceps extraction wounds described here and the sutured wounds, which it is proposed to discuss in a later article, were also intended to act as the basis for wider investigations into the healing of surgical extraction wounds. These investigations have been carried out and it is hoped to communicate the findings in due course.

It was decided to use macacus rhesus monkeys as experimental animals, as they resemble man much more closely than do the dogs and rats employed by previous investigators. Human material must be obtained by biopsy and autopsy, and the supply of suitable specimens is limited. Biopsy material is also liable to considerable damage in removal, and post-mortem specimens, usually obtained from patients who have suffered from serious illnesses, are not reliable as indicators of the normal healing processes.

The jaws and teeth of macacus rhesus monkeys are comparable with those of human beings, but there are certain differences in the roots of the teeth. The mandibular premolars have two roots which are placed mesially and distally; the maxillary premolars have one lingual root and two buccal roots; the maxillary and mandibular lateral incisors have curved roots with their apexes directed toward the midline.

It was found that the most suitable teeth for removal were the lateral incisors and the second premolars, but in two instances first molars, and in one, first premolars were employed.

It is possible to employ standard dental extraction forceps for the removal of the teeth. The instruments used for these experiments were upper and lower root forceps and upper straight forceps.

■ *Experimental Method*

The methods employed in the removal of the teeth were, so far as possible, those which would be applied in similar operations on human patients. Apart from certain difficulties which have been alluded to during the consideration

of macacus rhesus monkeys as experimental animals, it was possible to conduct the operations in a manner differing little from that normally employed in the surgery.

The animals were anesthetized with a mixture of alcohol, chloroform and ether, either administered continuously throughout the operation or used for induction alone and followed by pentobarbital sodium (Nembutal) administered intraperitoneally. Both methods were entirely satisfactory, but the use of pentobarbital avoided the necessity of having to interrupt the operation for the convenience of the anesthetist.

Teeth were removed at intervals so as to provide material for examination three days, or one to eight weeks after extraction. The five and seven week old sockets showed insufficient variation from those adjacent chronologically so that the analysis of the healing processes does not include direct reference to these specimens.

Forty teeth were extracted. Half the sockets were left untreated, the remainder being sutured. Seventeen monkeys were employed.

Specimens were prepared containing the sockets and their adjacent teeth. Serial sections were cut through the sockets usually in a labiolingual direction so that the alveolar crests could be best demonstrated. In four instances the blocks were cut in a mesiodistal plane to provide additional information.

■ *Results*

At three days (Fig. 1) the socket was filled with blood clot, the superficial part of which was infiltrated with leukocytes. Polymorphonuclear leukocytes, lymphocytes and plasma cells were contained in a network of fibrin, forming a fibrinous exudate which was dense at the surface but attenuated rapidly apically and extended only slightly below the level of the alveolar crests. The gingival margins tended to fold over the alveolar crests, and epithelial proliferation was beginning at their free edges. There were extensive remnants of the periodontal membrane on the walls of the socket. Fibroblasts were beginning to grow into the clot, especially at the base where capillaries were forming. No bone formation or resorption was seen. A small degree of fragmentation of the extreme crests of the alveolar bone could be observed; this resulted from mechanical injury during the removal of the tooth. The lacunae at the alveolar crests were empty, a condition not observed in specimens obtained immediately after the extraction of teeth.

At one week (Fig. 2) the socket was still mainly filled with blood clot but fibroblasts had penetrated to every part of it, being least numerous in the center. The superficial part of the clot still contained many inflammatory cells, although less than observed three days after extraction. The epithelium had proliferated over the undersurface of the projecting gingival margins, had reached the organizing surface of the clot and was beginning to proliferate over it. This appeared to be the normal means by which epithelization occurred, but in one instance favorable coaptation of gum margins and clot resulted in the production of a tenuous but complete covering in one week. Certain islands of epithelium seen toward the surface of the organizing clot were probably

cell rests separated from the periodontal membrane. That they were epithelial rests was suggested both by their appearance and by the absence of a connection with the surface as demonstrated in serial sections. Periodontal membrane remnants were visible on most parts of the socket walls. Appositional bone was forming on parts of the walls and trabecular bone in the fundus. The alveolar crests, some parts of the socket walls and a few marrow spaces adjoining the socket showed osteoclastic activity. These bony changes, however, were evidently at a very early stage of development.

At two weeks the blood clot had been completely organized. The socket was filled with trabecular bone except for a cone of fibrous tissue based at the socket mouth and tapering away at a depth of about one quarter of the distance from the crests to the base. The alveolar crests were being resorbed, but not very actively, and there was a certain amount of osteoclasia of the socket walls and contents toward the base, suggesting that reorientation of the bone was starting even at this early stage. The epithelial covering was complete but of uneven thickness. It lay on a thick, irregularly arranged layer of fibrous tissue which was infiltrated by moderate numbers of chronic inflammatory cells. A few remnants of the periodontal membrane were very indistinctly visible on the socket walls.

At three weeks (Fig. 3) the bone in the socket, in the form of trabeculae mostly parallel to its long axis, had almost filled the central depression seen at two weeks. Osteoblastic activity continued in the superficial part of the socket and along the walls. Osteoclasia of the alveolar crests, especially the lingual, continued and osteoclasts still could be seen on the walls and on the new trabeculae in the socket. The epithelium was still rather irregular, especially in its lower layers, and a small area of inflammatory infiltration remained in the center of the connective tissue layer beneath the epithelium. The subepithelial connective tissue was now much more mature, and mesiodistal sections showed regeneration of the transseptal fibers of the periodontal membrane. The bundles of fibers could be traced from the cementum of the tooth mesial to the extracted one across the socket to the cementum of the distal tooth.

At four weeks (Fig. 4) bone filled the socket or extended slightly beyond the level of the alveolar crests. The crests showed continuing resorption, but in places new bone was being laid down on them. Osteoclasia of the new bone in the socket continued slowly. The socket outlines for the most part were still clearly visible, but new appositional bone on the walls was making them uneven. The epithelium over the center of the socket was irregular. It was thicker than normal, and although the layers were differentiated, the basal cells had not yet acquired the columnar form seen in the epithelium which bounded the former epithelial defect. There was still a small area of inflammatory infiltration in the rather thick subepithelial connective tissue over the center of the socket.

At six weeks the new bone in the socket showed continuing resorption and deposition. The original tendency of the trabeculae to be orientated in the long axis of the socket was now lost. The lamina dura was not so well defined as

Fig. 1—Three day old socket filled with blood clot, superficial part of which is densely infiltrated with inflammatory cells. Small part of labial crest has been broken off—an unusual finding

Fig. 2—One week old socket. Gingival margins have come together; epithelium has proliferated along their deep surface and reached surface of rapidly organizing clot. Bone formation starting at base

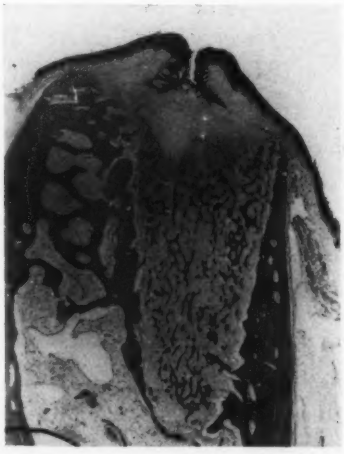

Fig. 3—Three week old socket. Bone fills most of socket and is still actively forming. Epithelium is well united. Some resorption of crests is occurring

Fig. 4—Four week old socket. Bone fills socket. Resorption of labial crest is reducing its height

Fig. 5—Eight week old socket. Bone has condensed at surface and has been resorbed at base. Socket outlines are very indistinct. Large part of labial alveolar plate has been resorbed

formerly, although there was little evidence of active resorption. There was a surface condensation of bone at the mouth of the socket, and bone continued to be laid down upon this, forming a rudimentary cortex. The soft tissue overlying the bone could now be described as mucoperiosteum. Resorption of the crests continued and had the effect of rounding the alveolar contour. The buccal crest was the more noticeably affected, and part of the new bone in the socket was exposed as a result of reduction of the height of the crest.

At eight weeks (Fig. 5) the surface condensation of bone was more pronounced. A small degree of resorption of the new bone in the base of the socket continued, but the most prominent feature was the resorption of the external plate of the alveolar process which had resulted in the uncovering of the new bone in the socket, the height of the crest having been reduced by as much as half the depth of the socket. This process was still active. Resorption of the internal crest was less noticeable and was confined to a rounding of the contour where the surface of the new bone abutted the crest. The new bone itself was not immune to these changes; it was resorbed together with the old to produce the smooth, curved surface which would appear to be the end result of the processes observable in action at this stage. The highest point of the edentulous ridge was toward the lingual side of the socket. A comparison of Figures 2 and 5 shows that the relative heights of the bone lingually and buccally had not been altered materially. The socket outlines were now definitely becoming indistinct, especially in the deeper parts of the socket. This diffusing of the outline had been produced partly by new bone deposition on the internal aspect of the socket walls and partly by resorption of the lamina dura, particularly from its external aspect.

The epithelium was well differentiated but continued to show a central irregularity; a few inflammatory cells were still noted in the connective tissue beneath.

■ *Discussion*

Extraction with forceps is the most common method of tooth removal. It has the advantages of speed and minimal trauma to the gingivae except when the operation is more than usually difficult, and it is unlikely that a tooth could be removed with less injury to the surrounding tissues than by this method, an opinion expressed by Schram[10] (1945).

Whenever a tooth is removed, the periodontal membrane must be divided throughout its extent, or the bone to which it is attached must be cut away or avulsed and the gingival tissues must be separated from the tooth. If forceps are used in the normal manner, the gingival tissues on the labial and lingual side of the tooth and the underlying superficial part of the periodontal membrane are divided by the blades. The mesial and distal gingival tissues are torn from the tooth during its removal and the attachment of the tooth to the bone is broken throughout its remaining extent, producing a wound which can only be described as lacerated.

In these circumstances it is remarkable that in the present experiments there was no evidence of pronounced injury to the gingival tissues or to the bone. Although in many instances the external alveolar crest was very thin, only one specimen provided evidence that a small piece of bone had been removed with the tooth and only a few others suggested a fragmenting of the extreme tips of the crests. No extraction resulted in tearing away of bone fragments from the lamina dura, which showed no signs of injury. Remains of the periodontal membrane frequently were seen on the socket walls, the fibers having generally been divided so that the part of the membrane nearest the tooth and containing the remains of Hertwig's sheath had been removed with the tooth. Frequently, however, epithelial cell rests could be seen in the cervical part of the socket.

Sometimes the strength of the periodontal membrane fibers had been such that, instead of breaking, they had avulsed small fragments of cementum and dentin from the root. These fragments could be seen either in situ near the alveolar crests or free above the crests or in the fibrous tissue covering the mouth of the socket. They did not produce an inflammatory response. It is possible that the breaking away of these pieces of cementum and dentin gives rise to the sharp cracking sounds often heard when a root is thought to have fractured and is found to be whole. They certainly were found more commonly than fractures of the alveolar bone.

The regeneration of the transseptal fibers observed at three weeks may have some influence on the tendency for adjacent teeth to move toward an empty socket. Chase and Revesz[11] (1944) observed regeneration of these fibers at five weeks in macacus rhesus monkeys. Beckwith and Williams[12] (1927-1928) previously had noted the regenerative power of the periodontal membrane after bur injury. It was observed, however, that in the present experiments remnants of the periodontal membrane left on the socket walls after extraction of teeth invariably degenerated and, so far as could be ascertained, took no part in the healing processes.

Schram[13] (1929) reporting his experiments on the extraction of the teeth of dogs and Mangos[7] using human material found that resorption of the buccal and lingual crests was slight. Euler[2] stated that osteoclasis ceased after four weeks. In the present experiments resorption of the crests, especially of the external one, was a noticeable feature and continued for at least eight weeks, although in the later stages it appeared to be part of a

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remolding process. An extreme example was seen in a seven week old wound, where the external plate had been resorbed almost to the full depth of the socket. However, before extensive resorption had occurred, the new bone forming in the socket had reached the level of the crests or extended somewhat above them so that the height of the ridge was maintained.

The inevitable exposure of part of the clot surface to the oral fluids no doubt predisposes to infection, but the resulting inflammatory reaction was confined to the superficial part of the socket. There is disagreement on the influence of saliva on the early stages of tooth socket healing. Russell[14] (1944) considered that the entry of saliva is the principal cause of dry socket. Clay[15] (1945) and Daniels[16] (1947) felt that saliva should be excluded, Clay advising the use of sulfonamides when saliva had entered the socket repeatedly during long operations.

Euler[2] referred to the removal of breakdown products by saliva and Spitzer[5] described salivary flow as an apparent factor in the healing of extraction wounds which "proceeds extraordinarily well in the absence of aseptic conditions." Osterloh[17] (1945) considered that saliva was not a factor in the production of dry sockets.

In respect to the excellent healing of wounds in the jaws, the experiments of Bancroft[18] (1914) on bone repair in dogs are of interest. Bancroft made cavities which were roughly equivalent in size to a tooth socket in the femurs of dogs and produced hemostasis before suturing the soft tissues over them. Several animals died, and in those in which repair occurred, 190 days were required for the bone almost to fill the cavities. This compares poorly with the 28 days Euler noted for bone to reach the level of the crests of a tooth socket and the 56 to 63 days Christopher[19] (1942) and Szabo[3] found to be required for complete healing in dog tooth sockets. Whether saliva is concerned in this remarkable variation it is impossible to state, but it is not unreasonable to suppose that it has some influence.

■ *Conclusions*

Examination of the experimental material indicates that the natural healing processes are ordinarily well able to contend with the injury produced by simple forceps extraction of teeth. It appears that the only directions in which improvement might be obtained are in the more certain and rapid epithelization of the surface defect, and in the earlier production of a stable bone condition. It is principally in these ways that surgical tooth removal could be thought advantageous.

■ *Summary*

Tooth extraction sockets in macacus rhesus monkeys were examined histologically at periods up to eight weeks after removal of the teeth.

Epithelization required between one and two weeks. The sockets were filled with bone in four weeks and had reached a fairly stable condition at the end of eight weeks. Bone formation was almost entirely limited by a line joining the tips of the alveolar crests.

Resorption of the labial alveolar plate was a constant feature, but the lingual plate was little affected.

The contour of the alveolar ridge was maintained by the new bone which filled the socket before appreciable resorption had occurred. At the end of eight weeks the socket outlines were largely destroyed.

*Senior lecturer in oral pathology, Sutherland Dental School, King's College.

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■ Intermedium of Information

Where should the practitioner forage for the latest information on what is new in his field? Frequently the editor of a conservative professional journal is overwhelmed with indecision about accepting a manuscript prematurely, and running the risk of indiscretion, at which time the reading public, including the practitioner, is well informed. Somewhere in the land of perplexity, there must be a cay of compromise so that the practitioner will not be forced to rely on the medicine section of the lay press to learn about the latest developments. Several devices have been suggested to alter the present unsatisfactory situation. . . . A professional journal should be receptive to manuscripts known in laboratory parlance as preliminary communications. These must be short in length and clear in presentation of a single fact or a group of related facts that have been subjected at a late date to critical study and found valid, thus leading to an apparently logical conclusion. A kindly eye should also be cast on manuscripts describing something new in basic science or clinical science. Neither the requirements nor the length will be as rigid. The communications on clinical science should be descriptive, without ponderous scientific terms and without confusing tables or complicated graphs. In each instance these will be signed communications. . . . The evaluation of the readers, in a letter to the editor, of this type of contribution will be helpful in adjudicating future policy.—*Editorial. J.A.M.A. 172:456 Jan. 30, 1960.*

Histological changes in bone after insertion of skeletal fixation pins

■ *Frank G. Pallan, D.D.S., M.S., Ambridge, Pa.*

Skeletal fixation pins frequently are used to stabilize extraoral appliances in the treatment of mandibular fractures. The thermal irritation to the involved bone is in direct proportion to the speeds used to insert the pins. Histological change that has been observed after insertion at high speeds is attributed to thermal insult whereas the changes seen at low speeds can be charged to physical injury. The greatest histologic response can be seen when the pins are left in position for eight weeks; the delayed pin loosening noted at eight weeks is attributed to delayed tissue response. The best method found to insert the pins was the Black and Decker Holgun electric power drill at speeds of 500 rpm. A completely accurate method of measuring the heat production during drilling was not found, but the higher speeds produced relatively higher temperatures and increased tissue response.

This study is a continuation of Thompson's[1] work to determine the histological changes occurring in bone after the insertion of extraoral skeletal fixation pins at various speeds. Thompson[1] stated:

> Although this study has indicated a desirable drill speed to be 500 rpm with the power drill, it does not rule out the possibility that aseptic thermal necrosis could develop from its use. A further study of the reaction of bone to drilling at longer intervals of time at the different speeds may possibly show whether aseptic thermal necrosis could be prevented by using this drill speed.

In this experiment, the pins were left in the dogs for 6, 8 and 10 weeks, in contrast to Thompson's work in which the pins were left in place for 24, 48 and 72 hours. The time intervals used in the present study were selected because they are representative of the time that pins remain in human beings undergoing treatment.

■ *Method*

The method employed is the same as Thompson's; that is, skeletal fixation pins were inserted into the mandibles of three dogs. Each dog had six pins in its mandible: three in the left and three in the right side of the mandible. Eighteen pins were inserted in all. The methods and speeds of insertion were as follows: the Black and Decker Holgun ¼ inch electric power drill was used to insert one pin in each dog at 250 rpm, one pin in

Table 1 • Thermal recordings in dog mandible

No. pins	Drill used to insert pin	Speed (rpm)	Drilling time (seconds)	Bone temperature (2 mm. from pin)
3	Hand	125	15	37
3	Power	250	12	41
3	Power	500	9	43
3	Dental	1,000	10	63
3	Power	1,000	7	60
3	Power	2,000	5	65

each at 500 rpm; one pin in each at 1,000 rpm, and one in each at 2,000 rpm. The conventional dental drill was used to insert one pin in each dog at 1,000 rpm, and the Brinell type hand drill was used to insert one pin in each dog at 125 rpm.

The dogs were sacrificed at intervals of six, eight and ten weeks after surgery. At these designated intervals, the mandibles were removed surgically and photographed; roentgenograms were taken. The mandibles were decalcified, and microscopic sections were prepared for histological studies.

In conjunction with this experiment, an attempt was made to determine the temperature produced by skeletal fixation pins at various speeds. Thermocouples were placed in the bone at a distance of 2 mm. from the drilling site. The thermocouples were attached to a Brown potentiometer which recorded temperature changes. The results are shown in Table 1.

The study showed only slight increase in bone temperature at drill speeds below 1,000 rpm. At 1,000 rpm and above, a sharp increase in temperature was noted. Therefore, it can be said that the temperature of the bone increases as the speed of the drill increases.

■ *Results*

Pathologic response of bone as influenced by skeletal fixation pin insertion at varying speeds and the duration of inserted pins was studied by visual, roentgenographic and histological methods. Histological examination disclosed the presence of all elements of an injured tissue. These changes were most pronounced when the speed of the drill for pin insertion was above 1,000 rpm and below 250 rpm.

Fig. 1—Right lateral jaw views of specimens showing no osseous changes. Pins inserted at 250, 1,000 and 125 rpm can be seen from anterior to posterior (right to left) respectively. Clinically, pins were securely embedded. Left: Six week specimen. Right: Ten week specimen

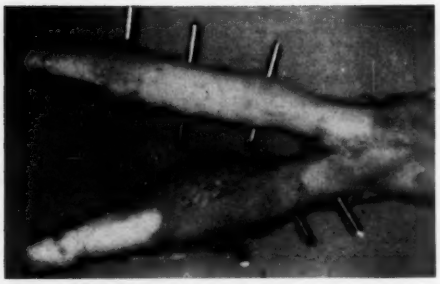

Fig. 2—Eight week specimen. Inferior view of mandible. Note severe reaction about pin inserted at 2,000 rpm. Clinically, pin was very mobile and remaining pins were only slightly mobile

Fig. 4—Right lateral jaw view of eight week specimen. Note evidence of circumscribed areas of necrosis about all pins. Pins inserted at 250, 1,000 and 125 rpm can be seen from right to left

Examination of the two canine mandibles which were resected six and ten weeks after pin insertion demonstrated only slight gross pathologic conditions and roentgenographic findings. All pins were securely embedded. Roentgenograms disclosed no radiolucent areas around pin-supporting bone of these two mandibles (Fig. 1).

Significant visual and roentgenographic changes were evident in the mandible which was resected eight weeks after pin insertion. The maximal osseous response was noted around the pin inserted at 2,000 rpm (Fig. 2 and 3). This pin was very mobile and could be extracted with slight effort. Adjacent to the pin and projecting to the inferior mandibular border, osteoblastic activity was pronounced (Fig. 2). The widespread osseous deposition revealed itself on roentgenograms as an area of density. The remaining pins in this mandible were only slightly mobile (Fig. 2 and 3). Circumscribed areas of necrosis could be noted around all the pins (Fig. 4).

Fig. 3—Left lateral view of eight week specimen. Note severe reaction about pin inserted at 2,000 rpm (left). Pins inserted at 500, 1,000 and 2,000 rpm can be seen from right to left respectively

The histologic changes which occurred about the pins in all the mandibles were focal and were never apparent more than 250 to 500 microns from the pins themselves. The changes noted were hemorrhage, exudate, nonviable bone, osteoclastic activity, fibrosis and osteoblastic reaction.

The tissue reactions were graded as slight, moderate and severe on the basis of the changes seen in all the slides and are relative to each other.

The most significant change, so far as the degree of destruction noted is concerned, was the presence of nonviable bone about the pins. Under routine micro-

Table 2

Six week specimens

Drill used to insert pin	rpm of pin insertion	Hemorrhage	Nonviable bone	Exudate	Osteoclastic activity	Fibrosis	Osteoblastic activity
Power	2,000–0	Slight	—	—	Moderate	Moderate	—
	1	Slight	—	—	—	—	—
Power	1,000–0	Slight	Slight	—	—	—	—
	1	Slight	—	—	—	—	—
Power	500–0	Slight	Slight	—	—	Slight	—
	1	Slight	Slight	—	—	—	—
Power	250–0	Slight	Slight	—	—	Slight	Slight
	1	Moderate	Moderate	—	—	—	—
Dental	1,000–0	Slight	Slight	Slight	Moderate	Slight	Moderate
	1	No reaction					
Hand	125–0	Slight	Moderate	—	—	—	—

0—Outer cortical plate.
1—Inner cortical plate.

Table 3

Eight week specimens

Drill used to insert pin	rpm of pin insertion	Hemorrhage	Nonviable bone	Exudate	Osteoclastic activity	Fibrosis	Osteoblastic activity
Power	2,000–0	Slight	Moderate	—	Slight	Severe	Slight
	1	Moderate	—	Moderate	Moderate	Severe	Moderate
Power	1,000–0	Moderate	Moderate	—	Slight	Slight	Slight
	1	Slight	—	—	Slight	Moderate	Moderate
Power	500–0	Moderate	Moderate	Slight	—	Moderate	Slight
	1	—	Slight	—	Slight	—	Slight
Power	250–0	—	Moderate	—	Moderate	Moderate	Moderate
	1	—	Moderate	Slight	Slight	Severe	Moderate
Dental	1,000–0	—	Slight	—	Slight	—	Slight
	1	—	Slight	—	—	Slight	Moderate
Hand	125–0	Moderate	Moderate	Slight	Slight	Severe	Moderate
	1	—	Moderate	—	—	—	Moderate

0—Outer cortical plate.
1—Inner cortical plate.

Table 4

Ten week specimens

Drill used to insert pin	rpm of pin insertion	Hemorrhage	Nonviable bone	Exudate	Osteoclastic activity	Fibrosis	Osteoblastic activity
Power	2,000–0	Moderate	Slight	Slight	Slight	—	Slight
		Moderate	Slight	—	Moderate	Slight	Slight
Power	1,000–0	Slight	Slight	—	Slight	Moderate	Slight
		No reaction					
Power	500–0	Moderate	Slight	Slight	Slight	—	Slight
		Slight	Slight	—	Slight	Moderate	Slight
Power	250–0	Slight	Moderate	Slight	—	—	—
		Slight	Moderate	—	Moderate	Severe	Slight
Dental	1,000–0	Moderate	Slight	—	Slight	Slight	Moderate
		No reaction					
Hand	125–0	Moderate	Slight	—	Moderate	Slight	Moderate
		—	Slight	—	Moderate	Slight	Moderate

0—Outer cortical plate.
1—Inner cortical plate.

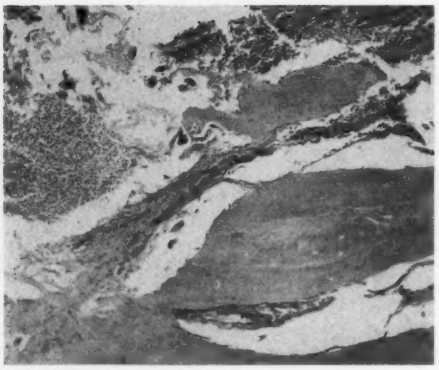

Fig. 5—Representative view of ten week specimen, showing periphery of pin inserted at 1,000 rpm

scopic examination nonviable bone is characterized by the absence of osteocytes. More detailed evidence is furnished, however, by the use of polarized light. Under such illumination living bone is birefringent and presents a definite pattern. Nonviable bone, conversely, offers a homogeneous appearance.

The observed histological changes were proportional to the amount of trauma produced, that is, the greater the degree of thermal irritation, the greater the degree of histologic activity (Table 1).

In the specimen from the animal sacrificed six weeks after pin insertion the histological response was generally slight at all drilling speeds (Table 2).

In the eight week specimen, the changes were most pronounced, ranging from moderate to severe at all drilling speeds (Table 3).

In the ten week specimen the response was slight to moderate, more pronounced than in the six week specimen but less so than in the eight week specimen (Table 4 and Fig. 5).

The greatest response was noted in the eight week specimens from the use of speeds above 1,000 rpm and below 250 rpm (Table 5 and Fig. 6).

The least amount of reaction was noted in the six week specimen when the speed of drilling for pin insertion was 500 rpm (Table 5 and Fig. 7, left).

According to Thompson's[1] and my results, heat produced in drilling is in direct proportion to speed, therefore, the histologic response at high speeds can be attributed to thermal trauma. Thompson,[1] in his study of acute changes in bone, noted considerable fragmentation at slow speeds. This study corroborates his results (Fig. 7, right). Consequently, the increased histologic activity at low speeds may be attributed to physical, rather than thermal, insult.

The study demonstrated slight changes in the six week specimen, severe alterations in the eight week one, and moderate activity in the ten week one.

Table 5

Severity of histologic changes about the pins related to drill speed

Drill	Speed (rpm)	Degree of reaction		
		Six week mandible	Eight week mandible	Ten week mandible
Power	2,000	None to moderate	Slight to severe	Slight to moderate
Power	1,000	None to slight	Slight to moderate	None to moderate
Power	500	None to slight	Slight to moderate	None to moderate
Power	250	None to moderate	Slight to severe	None to severe
Dental	1,000	None to moderate	Slight to moderate	None to moderate
Hand	125	None to moderate	Slight to severe	None to severe

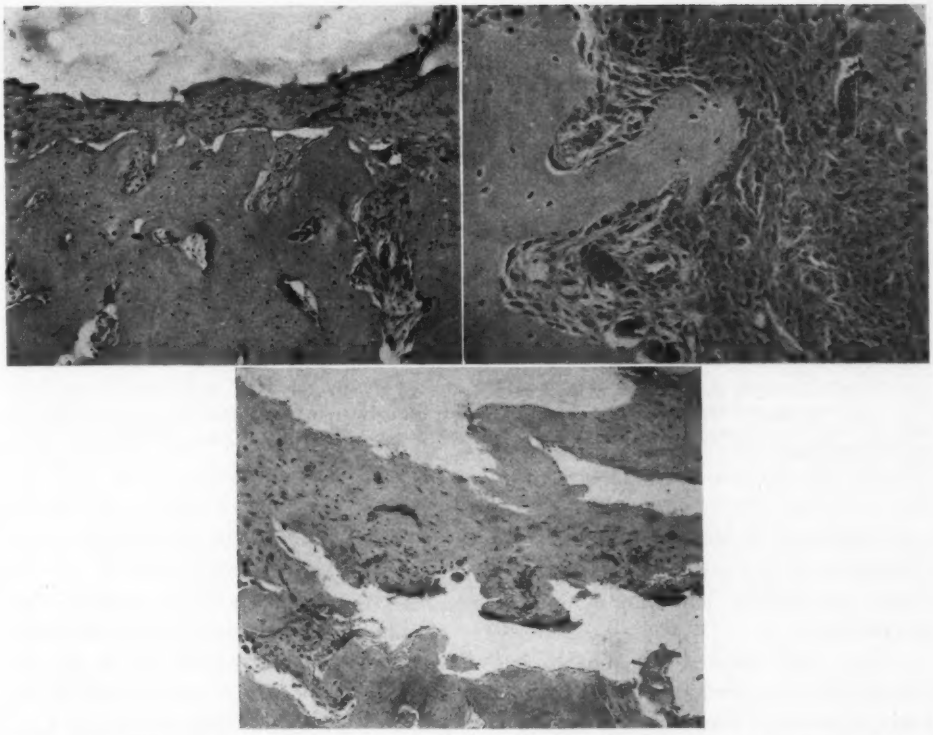

Fig. 6—Eight week specimens. Above left: View showing periphery of hole produced by pin inserted at 2,000 rpm. Note amount of granulation tissue about margin. Above right: High power view of section at left, showing periphery of pin inserted at 2,000 rpm. Below: Representative view of periphery of pin inserted at 125 rpm

■ *Discussion*

A common objection to extraskeletal fixation has been the pin "loosening" noted by many observers several weeks after insertion. This condition commonly has been attributed to local foreign body tissue response. This study, however, substantiates the opinion of Thompson that pin loosening is produced primarily by histologic changes after the initial trauma, principally heat, of pin insertion and, further, that such changes are proportional to the degree of trauma (heat) produced. These observations are confirmed by the histologic evidence derived in this investigation.

Additional verification of the process is shown by Table 5. The table shows the degree of tissue reaction to the various methods and speeds (the higher the speed, the greater the heat—see Table 1) and displays progressive catabolic changes, slight in the six weeks specimen, which reach their zenith during the eighth postoperative week. Hence, the delayed pin loosening is a direct function of delayed

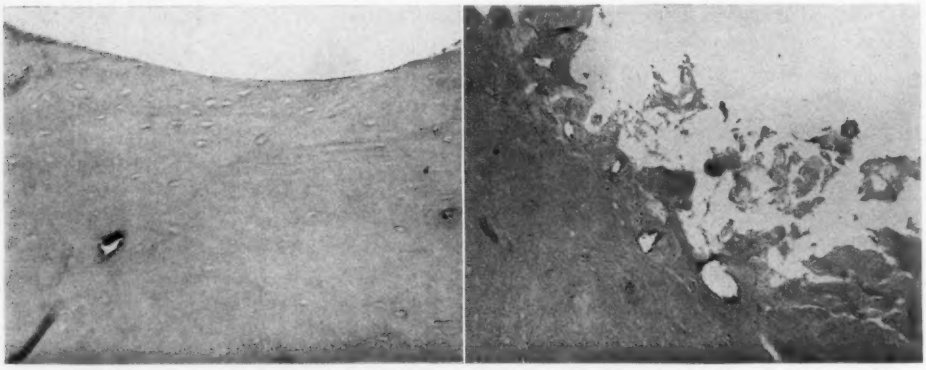

Fig. 7—Left: Six week specimen. View showing periphery of hole produced by pin inserted at 500 rpm. Note clean margin and absence of tissue reaction. Right: Six week specimen. View showing periphery of hole produced by pin inserted at 250 rpm. Note fragmentation and tearing of bone. Clinically, pin was securely embedded

tissue response. Tables 2-4 also reveal a diminution of destructive changes in the tenth week and the beginning of the repair process.

The study showed the pins to be firm after being embedded in bone for six weeks. However, after this period they began to loosen, and were mobile at eight weeks. This reaction can be attributed to a delayed tissue response and the beginning of necrosis. The necrosis progresses but seems to be limited by the process of repair which begins about the area of destruction. This may explain why pins become firm after being mobile when they have been in bone for more than eight weeks.

Of the three methods used to insert the fixation pins, the electric Holgun was found to be the most desirable, because it is easier to control, it is more steady and insertion is faster. The disadvantage experienced with the dental engine was the slippage of the belt, which made it more difficult to control the speed. With the hand drill, application was unsteady and insertion of the pins was slow.

To evaluate more accurately the methods of pin insertion, all three methods would have to be used at all the speeds with which these pins were inserted. This would be possible with the dental and power drill but not with the hand drill, since speeds above 250 rpm are improbable by manual operation. This is one of the limitations encountered in the study. I have found the power drill to be the best method for insertion of these pins.

A factor which I believe also contributes to the cause of necrosis about the pins is pressure. The limitations of this study prevented determining this, but pressure is a possible contributing factor. The pressure is that produced by the pin as it displaces the bone outward from the space it occupies. The pin used is not a self-cleansing pin and, therefore, the bone must be compressed about the periphery of the pin. Therefore, I believe that this pressure plays some part in the

production of osseous necrosis about the pins along with the thermal irritation. Orthopedic surgeons have overcome this pressure influence with the use of self-cleansing drills.

In the microscopic examination of the slides, hemorrhage was noted by the presence of red blood cells. The amount of this hemorrhage is not too significant because it depends on the amount of vessels the pin would penetrate, and this amount would be different for each pin. As was mentioned before, the most significant finding is the amount of nonviable bone present.

The heat studies carried out to measure the change in bone temperature during the drilling operation by no means indicate the actual temperature of the bone adjacent to the pin. The temperatures were recorded at a distance of 2 mm. from the pin. At this distance the actual heat produced was rapidly dissipated by the bone, blood and tissue fluid in the region. The highest temperature recorded was about 140°F. It is known that if a person touches the point of the drill as it comes through the lingual cortical plate, he gets burned. Therefore, the temperature of the drill must be above 200°F. The temperature readings in this study were far below this estimate and, therefore, are considered inadequate.

Considerable investigation was carried out to obtain a method of measuring more accurately the temperature of the drill. Thompson previously tried three methods without any success: (1) measurement of the outside temperature of the drill by attaching a thermocouple to it; (2) construction of a hollow drill and insertion of a thermocouple into it, and (3) the insertion of thermocouples in the bone adjacent to the pin. This last method I also tried and ended up with the same results.

The first method I investigated was the use of dyes. Some dyes change color at certain temperature ranges. Therefore, it was thought that if such a dye could be injected into the inferior alveolar artery it would penetrate the bone of the mandible, and the heat produced in drilling would give a color change indicating a certain temperature range. These dyes, however, are reversible, that is, they revert back to a colorless liquid as the temperature subsides. Consequently, before the mandible could be removed, the color would be gone. Other reasons for the dyes' not being used is that they would be destroyed in the decalcification process of the bone and would be ruined when the tissue sections were stained.

The second method investigated was the conversion of the drill into a thermocouple. A hole was drilled through the length of the drill and a wire was passed down the hole and soldered at the tip. Since the composition of the pin is 70 per cent iron, a constantin wire could be used, and thus an iron-constantin thermocouple was made. Calibration studies were carried out with good results. However, difficulties arose at the take-off point where the wires came off the drill. Electronics experts advised that since the drill would be moving, commutators would have to be used, as well as a cold junction. These, in addition to the heat produced by the drill, would create too much resistance for the amount of current generated, which is in millivolts, so that the reading would be inaccurate.

Electronics engineers advised that the use of thermistors was the only way of obtaining accurate measurements. Thermocouples, by their composition, produce a current when heated, and this current is affected by resistance. With a thermistor, on the other hand, a current is sent into it and the temperature produced by drilling is the only resistance offered this current; therefore, a more accurate reading can be obtained.

In this method a hollow drill is used, and a thermistor is placed into it and a direct reading taken. A thermistor that records temperatures in the 200° to 400°F. range is not a stock item, therefore a special thermistor as well as a special telethermometer to record the temperature would have had to be constructed. The cost of the equipment proved to be prohibitive.

■ *Summary and Conclusions*

Experimental studies were conducted to determine a drill speed that would produce the least amount of tissue destruction.

Eighteen skeletal fixation pins were inserted into the mandibles of three dogs with three different rotary instruments at speeds of 125, 250, 500, 1,000 and 2,000 rpm. The dogs were sacrificed at the end of six, eight or ten weeks. The resected mandibles were then processed and histologic sections prepared.

Microscopic examination revealed the histologic changes to be generally slight, severe and moderate in the six, eight, and ten week animals, respectively, with the greatest amount of tissue reaction occurring at the high and low drilling speeds.

Limited studies on heat showed that heat produced in drilling is in direct proportion to speed.

Conclusions derived from the experiments were as follows: The drilling speed producing the least amount of tissue destruction is 500 rpm; the best method of inserting skeletal fixation pins is with an electric drill. The duration for which the pins should remain in the bone is six weeks.

In actual practice to reduce heat and thus trauma, Archer[2] advocates running the drill for five seconds, shutting off the power, waiting 5 seconds, turning the power on again for 5 seconds, and continuing until the lingual cortical plate is encountered.—*717 Merchant Street.*

Abridgement of thesis submitted to the Graduate Faculty in the School of Dentistry, University of Pittsburgh, in partial fulfillment of the requirements for the degree of Master of Science.

1. Thompson, H. C. Effects of drilling into bone. J. Oral Surg. 16:22 Jan. 1958.

2. Archer, W. H. Oral surgery, ed. 2. Philadelphia, W. B. Saunders Co., 1956.

■ Criticism

Criticism is used to speaking in a voice of finality, for only by speaking so may it attract the attention that is necessary to its very life.—*George Jean Nathan, Testament of a Critic.*

Alveolitis sicca dolorosa (dry socket): frequency of occurrence and treatment with trypsin

■ *Erik Hjoerring Hansen,* D.D.S., Copenhagen, Denmark*

In the series described, dry socket occurred twice as frequently in the lower jaw as in the upper, and the incidence after surgical removal of teeth was more than three times that found after simple extractions. The use of trypsin to relieve pain and promote early healing shows encouraging results.

Dry socket, alveolalgia, alveolitis, localized osteomyelitis, postoperative osteitis and localized acute alveolar osteomyelitis are all names for the same condition; that is, a postoperative sequela characterized by absence of blood clot, exposed superficially necrotic alveolar bone, and severe pain. In this paper, the terminology suggested by Hjoerring Hansen and Pindborg[1] will be used. According to them, the condition described is called "alveolitis sicca dolorosa" in contrast to alveolitis granulomatosa which is a less painful postoperative sequela dominated by excess of granulation tissue. The so-called clinical socket,[2] in which the blood clot has been lost accidentally and which is not painful is termed "alveolitis simplex."

Many methods of treatment have been used for the afore-mentioned conditions. In recent years, the idea of using a proteolytic enzyme in the treatment of alveolitis sicca dolorosa has been discussed, chiefly because of the good results obtained by its use in general surgery. The reason a proteolytic enzyme is useful is that one of the factors in alveolitis sicca dolorosa is the inflammation with necrosis of tissue. The proteolytic enzyme removes the necrotic tissue and cleans the wound surface thus producing good conditions for healing. One of the enzymes used is trypsin.

Trypsin is a proteolytic enzyme secreted by the pancreas. It can be isolated as a crystalline protein. Trypsin digests proteins into polypeptides which are further hydrolyzed in normal digestion by peptidases into simple peptides or amino acids.[3] When trypsin is applied to a purulent and necrotic lesion, it lyses the coagulum and the fibrinous strands in a few minutes. Trypsin digests the coating of the purulent exudate consisting of desoxyribonucleoprotein and then attacks any dead tissue in the lesion. During the digestion there is an outpouring of serum which removes the digested debris. The

Table 1 • Results of previous investigators after use of trypsin in treatment of alveolitis sicca dolorosa

Author	Year	Number of cases	Drug applied	Dosages and enzyme activity	Results
Faillo	1948	More than 100	Proteolytic enzyme powder	Dusted on gauze and inserted in alveolus	Good
Anderson	1957	40	Crystalline trypsin in Soerensen's buffer solution	1/12 of an enzyme activity according to 250,000 Armour units in 7 cc. buffer solution kept in alveolus for 15 minutes	Treatment period 8 days in contrast to eugenol-gauze, 13 days
Soested	1957	16	Trypsin cones and trypsin paste	Cones activity according to 31,200 Armour units. The activity of 1 Gm. paste 125,000 units. 1 to 3 cones in the alveolus covered with the paste	Without pain from ½ to 24 hours from 1 application
Spiegel	1958	?	General: 600,000 units procaine in penicillin injection + 500 mg. tetracycline injection every four hours in four days + lyophilized watery trypsin injected + Local: 5 per cent lidocaine for 5 minutes Irrigating with trypsin solution Gauze with trypsin solution in alveolus for 15 minutes Covering of alveolus with zinc oxide-eugenol paste		75 per cent of the patients were free from pain the next day

bacteria decrease rapidly in number and may gradually disappear.[4,5] Trypsin itself is not bactericidal or bacteriostatic, but by removing the necessary foodstuff, the necrotic tissue, it restrains bacterial growth.

Trypsin has been used in surgery for treatment of necrotic lesions resulting from burns, tuberculous empyema, chronic osteomyelitis, carcinomatous ulcer of the chest wall and diabetic gangrene.[5]

In dentistry trypsin has been used for treatment of periodontal lesions with good results, especially in patients with acute necrotic gingivitis.[6,7] It has also been used, either alone[8] or combined with an antiseptic,[9] in the treatment of necrotic pulps.

The use of trypsin for treatment of dry socket has been advocated by several investigators.[4,10-12] The results of the previous investigations are summarized in Table 1. It can be seen that the use of trypsin is effective in the treatment of this condition.

■ *Present Investigation*

FREQUENCY—The investigation reported here, which was begun September 1, 1957, and concluded August 31, 1958, was carried out at the Dental Clinic, Naval Base, Copenhagen. Enlisted men, in the age group 18 to 25 years, were used in the study. During the one year period, 1,079 teeth were removed, 861 by simple extraction and 218 by surgical procedures. All operations were performed with the patients under local anesthesia (lidocaine (Leostesine hydrochloride 2 per cent, epinephrine 1:100,000)). The distribution according to location and according to individual teeth or removed teeth is seen in Table 2. The relatively high incidence of removal of lower third molars can be ex-

plained partly by the age of the patients and partly by the fact that lower third molars were often removed because a necrotic gingivitis (which is common in the Royal Danish Navy) might recur in the region of partially erupted lower third molars.

Immediately after the extraction the alveolus was covered with a large gauze-tampon and the patient instructed to keep his teeth in contact for 20 minutes. When the gauze was removed, a blood clot had been formed. The patients were not allowed to rinse their mouths before this clot had formed. If periapical lesions were observed, the alveolus was curetted before the gauze was applied; if the gingiva was delacerated, it was cleaned.

In 33 instances (30 patients), alveolitis sicca dolorosa developed. After simple extractions the incidence was 2.0 per cent, whereas after surgical removal it was 7.3 per cent. Table 2 shows that alveolitis sicca dolorosa occurs twice as frequently in the lower jaw (4.1 per cent) as in the upper (2.0 per cent). According to individual teeth, the first and third molars in the lower jaw show the highest incidence (5.8 per cent), followed by the maxillary second molar, the mandibular second molar, the maxillary bicuspids, the maxillary first molar, the mandibular bicuspids and the maxillary third molar. No instances of alveolitis sicca dolorosa occurred in incisors or cuspids. Ten instances of alveolitis simplex were seen, 1 in the upper jaw, 9 in the lower jaw, 6 of these after removal of lower third molars.

The main complaint of patients with alveolitis sicca dolorosa is severe pain. In this study, the onset of pain was from the end of anesthesia and up until seven days after; in 20 instances, or 60 per cent, the pain occurred within the first four days.

TREATMENT—The trypsin was used in the form of cones containing 5 mg. pure crystalline trypsin with an enzyme activity of 31,200 Armour units and a 5 per cent, a 2 per cent and a 1 per cent

Table 2

Distribution of removed teeth and frequency of occurrence of alveolitis sicca dolorosa

	Incisors and cuspids	Bicuspids	Molars			Total
			1st	2nd	3rd	
Upper jaw						
No. of teeth removed	91	145	95	91	134	556
No. with alveolitis sicca dolorosa	0	4	2	4	1	11
% with alveolitis sicca dolorosa		2.8	2.1	4.4	0.75	2.0
Lower jaw						
No. of teeth removed	39	69	137	106	172	523
No. with alveolitis sicca dolorosa	0	1	8	3	10	22
% with alveolitis sicca dolorosa		1.5	5.8	2.8	5.8	4.2

Table 3

Distribution of teeth removed by simple extraction and frequency of occurrence of alveolitis sicca dolorosa

	Incisors and cuspids	Bicuspids	Molars			Total
			1st	2nd	3rd	
Upper jaw						
No. of teeth removed	84	116	78	81	124	483
No. with alveolitis sicca dolorosa	0	1	1	2	1	4
% with alveolitis sicca dolorosa		0.9	1.3	2.5		0.8
Lower jaw						
No. of teeth removed	39	63	116	85	75	378
No. with alveolitis sicca dolorosa	0	1	5	2	5	13
% with alveolitis sicca dolorosa		1.6	4.3	2.4	6.7	3.4

trypsin paste containing 50, 20 or 10 mg. of pure crystalline trypsin per gram of paste, with an enzyme activity of 312,000, 125,000 and 62,500 Armour units.[13] Thirty-two cases were treated with cones and paste. The cones were placed directly in the alveolus without irrigation prior to application. They were covered with the trypsin paste nearly filling the alveolar defect. In 4 instances of alveolitis sicca dolorosa, a 5 per cent trypsin paste was used, in 1 a 2 per cent, and in 28 a 1 per cent paste was used. The alveolus was not irrigated prior to application in order to eliminate the effect of mechanical cleansing thus leaving the effect to trypsin alone. The average number of applications of trypsin was two, the period between the two applications being three hours. If a third application was considered necessary, it took place 24 hours after the first. In one instance a 15 ml. isotonic saline solution containing 50 mg. pure crystalline trypsin with an enzyme activity of 312,000 Armour units was used. The alveolus was irrigated with the trypsin solution, then kept dry with cotton rolls and filled with the solution, which was allowed to remain for 15 minutes. The treatment was repeated twice, with 24 hours between treatments.

RESULTS—The term "relief from pain" in Table 3 refers to the moment when the patients were totally free from pain. In 14 cases of alveolitis sicca dolorosa, there was no pain two and a half hours after the first application, in 15 pain was relieved 48 hours after the first application, and in four cases, the pain was not reduced after two applications of trypsin. If the pain did not subside after two applications, the trypsin was discontinued and the alveolitis sicca dolorosa was treated with iodoform-gauze and eugenol. In the dental department, University Hospital, during the same period, trypsin was used in the treatment of five patients with alveolitis sicca dolorosa. In one there was a negative result; in the rest a clear reduc-

Table 4

Distribution of teeth removed by surgical procedure* and frequency of occurrence of alveolitis sicca dolorosa

	Incisors and cuspids	Bicuspids	Molars			Total
			1st	2nd	3rd	
Upper jaw						
No. of teeth removed	7	29	17	10	10	73
No. with alveolitis sicca dolorosa	0	3	1	2	1	7
% with alveolitis sicca dolorosa		10.3	5.9	20.0	10.0	9.6
Lower jaw						
No. of teeth removed	0	6	21	21	97	145
No. with alveolitis sicca dolorosa		0	3	1	5	9
% with alveolitis sicca dolorosa			14.3	4.8	5.2	6.2

*All upper and lower third molars listed in this table were partly or totally impacted. Other teeth were removed surgically because of extensive caries destruction and fracture during extraction.

tion in pain intensity was obtained within 48 hours after the first treatment.

COMPLICATIONS—In 18 patients there were no complications, in 8 mild, and in 4 patients severe complications developed. Complications of trypsin treatment consisted of a burning feeling of the tongue, the palate and the buccal mucosa in the region of the alveolitis sicca dolorosa; one patient had aphthalike lesions of the palate in the area of the empty alveolus. The symptoms all disappeared when the trypsin was discontinued. There was no correlation between the four patients in whom there was no relief in pain and the four in whom the severe complications developed. In only one instance were both conditions found.

■ *Discussion*

The frequency of occurrence of alveolitis sicca dolorosa (3.2 per cent) found in this investigation is high compared with the frequency noted by other investigators. Krogh[14] found 2.2 per cent, Archer[15] 0.9 per cent, and Adkisson and Harris[16] 2.1 per cent. Waite[17] mentions 10 per cent occurrence with no further statement about the high number. Two per cent of the instances occurred after simple extractions, whereas 7.3 per cent occurred after teeth had been removed by surgical procedures. If the frequency of occurrence of alveolitis sicca dolorosa in each group is compared (Tables 3, 4), it will be seen that there is a higher incidence in teeth surgically removed with the exception of the lower third molar. Also there is a considerable difference in the total frequency of occurrence between teeth extracted and those that were surgically removed. It must be emphasized, however, that the number of teeth, especially in Table 4, is too small to draw definite conclusions. These figures can be compared with the figures reported by Krogh[14] in 1937 when he divided his ma-

terial according to "difficulty of removal Grade I-IV." His Grade I corresponds to the simple extraction without trauma and Grade IV to those teeth most difficult to remove. He found an increasing number of instances of alveolitis sicca dolorosa varying from 0.7 to 23.5 per cent and corresponding to their classification of Grades I to IV.

Contrasted to this are Archer's[15] observations on 23,886 extractions. He noted no difference with regard to trauma; 126 instances or 56 per cent followed definite trauma; 100, or 44 per cent, followed simple extractions in which there had been no remarkable trauma.

The high incidence of alveolitis sicca dolorosa developed after removal of the upper second molar (4.4 per cent, Table 2), and the ratio of 2:1 between the frequency of occurrence in the mandible and the maxilla is not in accord with previous reports. Krogh[14] noted 25:1; in Archer's[15] examples, 79 per cent occurred in the mandible; in Adkisson and Harris,[16] 84 per cent, and Waite[17] observed a 9:1 ratio of frequency as between mandible and maxilla. Perhaps an explanation can be found in the fact that the extractions in this series were done by eight dentists who, at the time of the study, had not had much training in extraction of teeth. The mechanical trauma associated with extractions is one of the most significant etiologic factors in the development of alveolitis sicca dolorosa.

The observations in the present investigation regarding the time of onset of pain are in accord with those of other investigators. Archer[15] mentions onset of pain occurring from when the effects of the anesthesia had worn off up until seven days; Waite[17] noted 2 to 10 days, frequently 3 to 4 days, and Spiegel[12] 1 to 7 days for the onset of severe pain.

The use of crystalline trypsin dissolved in an isotonic saline solution was discontinued because in solution, unstabilized trypsin loses approximately 40 to 50 per cent of its enzyme activity when stored for three hours.[8] The trypsin used in this investigation was stabilized by the use of calcium salt. Even then it lost enzyme activity in solution when stored for a longer period. Trypsin administered in cones and paste is stable indefinitely at cool temperatures and was used throughout the investigation.

In all patients treated, the cleansing effect of trypsin was very good. In many instances, after the second application an initial formation of granulation tissue could be seen at the bottom of the alveolus.

From a review of the work of earlier investigators who used trypsin in the treatment of alveolitis sicca dolorosa (Table 1), it can be seen that the time for onset of relief of pain ranges from a half hour to eight days. In this study, relief was obtained after one half hour to 48 hours in 87 per cent of the patients (Table 5). This observation is in agreement with the observations of Soested[11] who used the same brand of trypsin under almost the same conditions as those in the present investigation. Spiegel[12] mentions that 75 per cent of his patients were free from pain the next day, but, because of his rather complicated treatment, it is difficult to ascertain what had this beneficial effect.

I believe that antibiotics such as penicillin and tetracycline should not be used in the treatment of alveolitis sicca dolorosa since only small quantities of antibiotics

Table 5

Results of the trypsin treatment

Number of cases of alveolitis sicca dolorosa treated with trypsin	33
Time of onset of severe pain after removal of tooth	Shortest period: 1 day, when anesthesia wore off. Longest period: 7 days. Average: 3.1 days
Method of application	Cones containing 5 mg. trypsin paste with 5 or 2 of 1 per cent concentration of trypsin. Crystalline trypsin dissolved in isotonic solution.
Number of treatments	From 1 to 4 times Average 2 times
Relief from pain in hours from the first application	14 cases from ½ to 3 hours, average 2½ hours. 15 cases from 24 to 48 hours, average 37 hours. 4 cases had no reduction in pain intensity.
Complications	18 patients free from complications 8 patients had mild complications 4 patients had severe complications

come in contact with the affected region and there is always the risk of sensitizing the patient to antibiotics.

Regarding other methods of treating the condition, Krogh[14] states in the table, "Day of last treatment," that in 102 instances out of 138, the treatment stopped from the seventh to the tenth day. His method in all cases was the flushing of the socket and then inserting a strip of gauze impregnated with various drugs. Those most frequently used were Conducto, guaiacol and glycerine, and eugenol. Adkisson and Harris[16] mention that the majority of their patients required five days of treatment; after a week of treatment 60.3 per cent were free from pain. Sutures, hypnotics or sedatives and antibiotics were used in their treatment.

The fact that 29 patients (87 per cent) in the present investigation were free from pain 48 hours after the first application means that trypsin is an effective aid in the treatment of alveolitis sicca dolorosa. Complications may be encountered, however, which are mild in most instances. Only when the concentration of trypsin is high (5 per cent) do the complications justify discontinuance of the treatment.

■ *Summary*

In a total of 1,079 extractions performed at the Navy Dental Clinic in Copenhagen, alveolitis sicca dolorosa (dry socket) occurred in 33 instances (3.2 per cent). The 33 (comprising 30 patients) were treated with trypsin administered as cones and paste. The severe pain disappeared completely within 48 hours after the first application in 87 per cent of the patients; 13 per cent did not show improvement after two treatments. Among the 30 patients treated, 18 developed no complications, 8 had mild and 4 patients had severe complications from the trypsin.

*Dental Department, University Hospital, Copenhagen, Denmark, and Dental Clinic, Naval Main Base, Copenhagen.

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The management of mandibular fractures in children

■ *George G. Graham,* D.D.S., New Orleans, and James R. Peltier,† D.D.S., Thibodaux, La.*

Mandibular fractures in children are relatively infrequent, although they may sustain this type of injury from falls, automobile accidents, playground accidents, and so on. After complete physical evaluation and roentgenographic examination, and associated injuries have been ruled out or are being treated, thought must be given to management of the fracture. Several factors which must be considered are: adequate immobilization, noninterference with growth centers, rapid callus formation with resultant rapid healing, tooth buds or partially erupted teeth in line of fracture, and nutrition. The simplest method of treatment is usually the best. Technics used in treatment of mandibular fractures in adults may be adapted and used in children. Intermaxillary wiring, splints with circumferential wires, orthodontic bands and open reduction have been used successfully, as well as no definitive treatment in selected instances.

Fractures of the mandible in children are relatively infrequent because of the great resiliency of young bones. Kazanjian and Converse[1] have stated that 10 per cent of mandibular fractures treated by them occur in children between the ages of 4 and 11. Statistics at Charity Hospital of Louisiana at New Orleans indicate that this figure is high. We are more inclined to agree with Panagopoulos[2] who states that in his experience 1.4 per cent of all jaw fractures occur in children.

■ *Treatment*

Immediately after a patient in whom a mandibular fracture is suspected has come for treatment, a thorough physical survey is mandatory to rule out associated injuries. If serious complications should prevent early definitive treatment of the

fracture, a simple wire loop around two or three teeth provides excellent temporary reduction; this may also be helpful in the control of pain, hemorrhage, or airway obstruction from unsupported soft tissues.[3] The application of a Barton bandage for temporary immobilization in children is not recommended as this causes a further decrease in available air space.[4] If obstruction is imminent, the child should be placed in the prone position, and a suture or towel clip used to pull the tongue forward. If this is not sufficient, a nasopharyngeal airway may be employed.[5]

After associated injuries have been controlled, it is advisable to administer a sedative to the apprehensive child so that a thorough clinical examination can be accomplished and acceptable roentgenograms obtained.[6] Lateral oblique and posteroanterior views of the mandible are routinely ordered. It is advisable to take temporomandibular joint and reverse Townes' projections when a condyle fracture is suspected. A complete history and detailed account of the circumstances surrounding the present injury are always obtained. The usual thorough visual and manual examination is made of the facial skeleton, teeth, and supporting structures. Associated soft tissue lacerations should be noted, but it is best to postpone closure until the fracture is reduced unless there is to be some delay in the reduction.[7] This is suggested as necessary fracture manipulation may disrupt or contaminate the wound.

In planning treatment of mandibular fractures in children, several factors peculiar to this age group must be considered. First, reduction methods should not interfere with mandibular growth if serious facial deformity is to be avoided.[7] This applies particularly to fractures involving the condylar growth center.

Callus formation in young children is rapid, often leading to fixation in a few days. This makes early treatment leading to anatomically correct reduction mandatory, as late manipulation of displaced fragments is difficult. Slight derangement of the deciduous occlusion should be accepted if a callus has already formed rather than attempting to refracture and reposition the fragments. Any high cusps causing disrupting movement across the fracture line should be relieved by spot grinding. Small occlusal imperfections that remain will be overcome with the eruption of the permanent teeth.[8]

Jaw fractures in children very frequently involve tooth buds or partially erupted permanent teeth; but it is seldom necessary to remove these teeth unless they prevent proper reduction of the fracture. Antibiotic therapy, and, if necessary, drainage should overcome any infection resulting from compounding into the mouth.[9] There have been instances reported of delayed eruption, dilaceration, and degrees of malformation of the crown after a fracture through a tooth bud, but no cystic degeneration or neoplasm has been reported which could be attributed to a previous fracture.[6]

Nutrition and hygiene, always problems in patients with jaw fractures, take on added importance in children. Poor fluid balance accompanied by poor nutrition inevitably leads to increased morbidity. In order to avoid complications, the additional nutritional needs for tissue repair and growth must be supplied. Chil-

Fig. 1—Stout wiring for undisplaced fracture of body of mandible in six year old child. Deciduous teeth only were utilized

dren require approximately 60 cc. of fluid per pound per day. Daily caloric requirement varies from 40 calories per pound for a 19 month old baby to 30 calories per pound for a 14 year old.[5] Occasionally it may be necessary to resort to tube feeding with nutritional supplements, but in most instances oral liquids and blended solid foods ingested with the aid of a bulb syringe will supply adequate intake. Hygiene can be maintained with hydrogen peroxide and saline mouthwashes together with gentle cleansing and brushing. A soft, child-size brush is recommended for all children with fractures.

Some children make determined efforts to remove elastics, wires and splints. In these obstreperous individuals, elbow cuffs should be placed to prevent interference with fracture treatment.

As a rule, hurt children are apprehensive, uncooperative patients, and the approach must be gentle, efficient and sympathetic. General anesthesia is advisable for even minor fracture manipulation in children.[1,4,5,7,10] Hospitalization usually is necessary not only for the anesthesia, but also for the special postreduction care described earlier. Antibiotics are administered prophylactically in all patients with compound fractures.

Most methods used in the reduction of mandibular fractures in adults have been advocated for the treatment of these injuries in children. The ideal method is the simplest, most efficient one which will produce adequate reduction and stabilization. "In certain cases, where displacement is nil or minimal, and there is no discomfort or motion in the fracture line, simple rest without fixation usually will suffice."[7]

When rigid fixation is essential, dental wiring is the treatment of choice provided the deciduous or permanent teeth have adequate root support[1,2,8,9] (Fig. 1). Panagopoulos[2] states: "Most of the radical procedures are terminated by conservative measures, such as wiring, which might have been sufficient alone." Small gauge .015 wire rather than the usual .020 wire is used routinely for children. In many instances arch bars are preferred to loop wiring. They are used whenever diastemas or missing teeth prevent good adaptation of continuous dental wiring. Also, in those patients in whom the fragments can be manually reduced to correct alignment, it is possible to place a rigid bar across the fracture site and gain added stabilization. If elastic traction is necessary to reduce displacement, the elastics should be replaced with intermaxillary wires as soon as possible to relieve pressure on the supporting root structure. Provision should be made for cutting the wires if there is any evidence of impending nausea.

In those few instances in which the deciduous or mixed dentition will not

support conventional dental wiring, acrylic or metallic splints with circumferential wires may be used.[11] Those authors[6,7] who feel that dental wiring is generally inadequate in children also advocate the use of splints. This method is satisfactory and has the distinct advantage of allowing free mandibular motion as intermaxillary traction usually is unnecessary. They generally are unsatisfactory for angle fractures and the taking of a suitable impression is difficult and often requires general anesthesia.[12] If two anesthetic inductions are required to complete placement of splints, then this procedure is an unnecessary risk. MacLennon[6] seeks to circumvent this disadvantage by using a prefabricated splint lined with gutta-percha.

Orthodontic bands[2,13] for fracture reduction are effective, but the added manipulation and expense render them impractical for routine use. They may be considered, however, for realigning a malposed fracture without surgical interference.[7]

The use of external pin fixation and blindly driven Kirschner wires or Steinmann pins is almost unanimously condemned because of the danger of injury to the permanent tooth follicles[2,5-7,9,14] and the unsightly, dimpled scars that may result. However, both Georgiade[5] and Reiter[15] report the safe use of a Kirschner wire in symphysis fractures, and Archer[16] reports he has used pins in two patients with subcondylar fracture.

Elaborate head caps with extensions, slings, or elastic traction should be used in children only as a last resort because they are annoying and inviting targets for interference by uncooperative patients.

Conservative treatment of condyle fractures in children (Fig. 2) is favored because of the very real danger of serious deformity that might result from surgical interference with the condylar growth process.[8,17-19] Dessner and Holm[20] made a one to six year follow-up of conservatively treated condyle fractures, and reported complete functional healing in all patients observed, and gradual remodeling of the dislocated condyles. Condyle fractures in children need be immobilized only two to three weeks, and postreduction exercises are recommended to speed return to full range function in order to help minimize the possibility of ankylosis.

The use of open reduction with direct interosseous wiring in fractures of the juvenile mandible has increased in popularity with the advent of antibiotics, improved surgical technics, and advanced pediatric anesthesia. This approach is indicated in badly displaced body or angle fractures where conservative methods fail to produce satisfactory results. The main criticism that has been made of this approach is possible interference with the permanent follicles,[6] but this danger can be eliminated if the operator is careful to place the drill holes close to the inferior mandibular border (Fig. 3). Only one hole is placed in either fragment as the bone is too thin to permit successful "cross X" wiring as is used in adults. Open reduction permits direct visualization with subsequent superior accuracy of alignment and stability of fixation. Intraoral wiring sometimes may be eliminated giving the added advantage of a full soft diet almost immediately, and eliminating the disagreeable period of jaw immobilization. Also, there are no appliances to in-

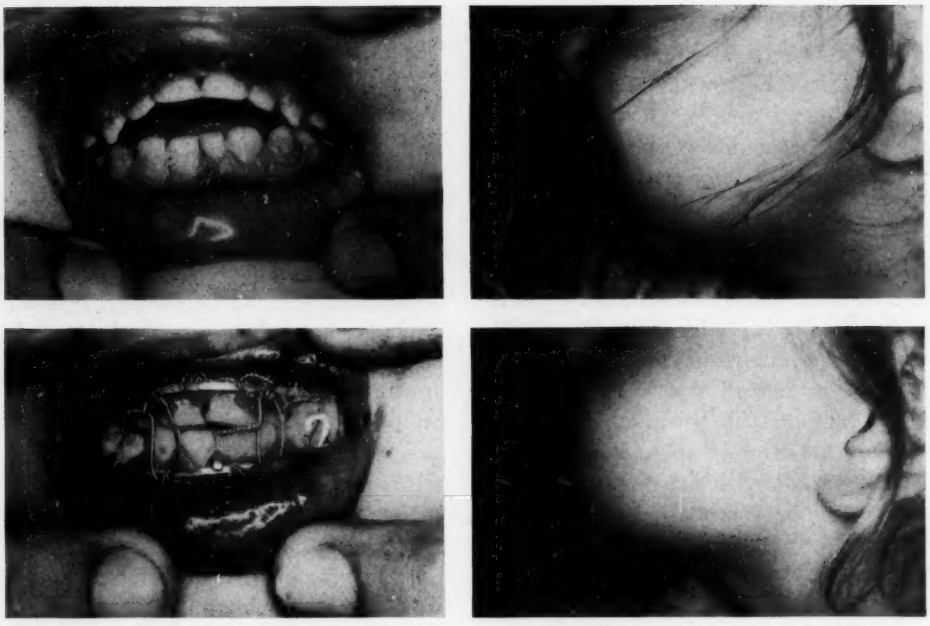

Fig. 2—Above left: Preoperative posterior telescoping and anterior open bite from bilateral condylar fractures in 29 month old child. Above right: Resulting facial deformity. Below left: Use of arch bars and elastic traction to restore normal occlusion. Below right: Restored postoperative profile

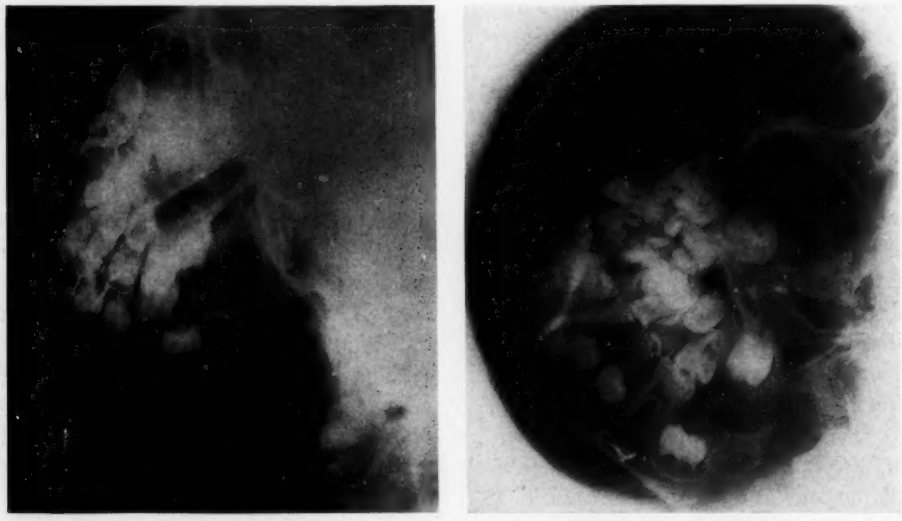

Fig. 3—Left: Immediate postoperative roentgenogram after open reduction of mandible in child. Right: One year later, showing no interference with normal eruption

Fig. 4—Left: Three year old child with badly displaced double compound fractures of left side of mandible. Wheel of horse-drawn wagon had rolled over this patient's face. Center: Preoperative posteroanterior roentgenogram. Right: Preoperative lateral oblique view

vite patient interference. The disadvantages of possible unsightly scarring and injury to the facial nerve or tooth follicles are eliminated by a skilful, experienced surgical approach. Kazanjian and Converse[1] and Matthews and Magruder[14] all report successful use of open reduction in young children. We also endorse direct interosseous wiring as a superior method of treatment for badly displaced mandibular fractures (Fig. 4, 5).

■ *Survey of Cases*

A survey of the in-patient records of Charity Hospital over the past 12 years has indicated 31 mandibular fractures in children up to and including the age of ten years. The causes of these fractures were as follows: falls, 8; hit by automobile, 5; kicked by horse, 5; playground accidents, 4; fist fights, 2; gunshot, 1; run over by wagon, 1.

Seven of the cases reviewed suffered more than one break with a total of 39 individual fractures being recorded. The anatomic location of these mandibular fractures was body, 22; symphysis, 6; angle, 5; neck of condyloid process, 5; anterior alveolar process, 1. It is of interest to note that 70 per cent of these oc-

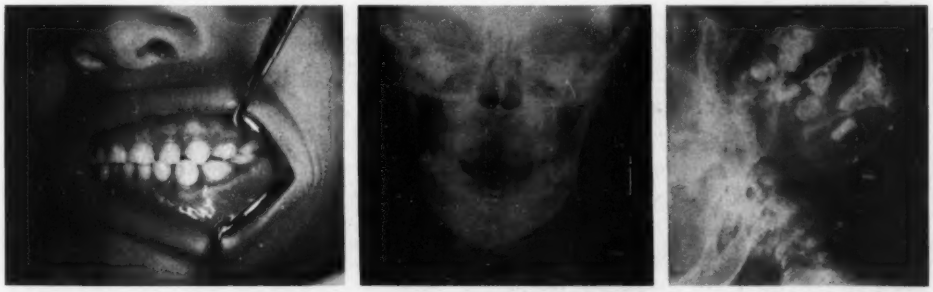

Fig. 5—Left: Postreduction occlusion after treatment with double open reduction plus arch bar in patient shown in Figure 4. Center: Postoperative posteroanterior roentgenogram. Right: Postoperative lateral oblique view

curred through or near the deciduous teeth and developing permanent tooth buds. Two thirds were compounded into the mouth. The total of only five condylar fractures is incongruous with the literature, as the majority of reported cases involve this region.[13, 17, 19, 20-22]

The treatments used for the 39 fractures in children were as follows: no definitive treatment, 8; intermaxillary wiring—Stout or loop wiring, 14; arch bars, 8; extraoral open reduction with arch bars, 5; extraoral open reduction with Stout or loop wiring, 2; intraoral splint with circumferential wires, 1; head cap with elastic sling, 1. Seven of the eight fractures that were not actively treated because of little or no displacement healed without complications. The exception was a neck of a condyloid process which healed but reportedly caused a malocclusion. This case history emphasizes the seriousness of condyle injuries in children and the need for careful diagnosis and prompt conservative treatment. It should be noted that in 90 per cent of the patients receiving definitive treatment, some type of intermaxillary dental wiring was used. These patients ranged in age from two to ten years. All types of fractures were included as to location, degree of displacement, severity, and so on. Over-all results were very good with adequate reduction and stabilization being achieved in the majority of instances by dental fixation alone.

In seven bady displaced fractures, however, intermaxillary dental fixation was found to be inadequate; extraoral open reductions were necessary. Follow-up of these patients reveals rapid healing, normal function, minimal scarring, and no interference with permanent tooth eruption and facial development.

Complications encountered in all instances were: (1) a malocclusion as noted earlier from the untreated condyle fracture, (2) delayed healing in one badly comminuted symphysis fracture, (3) an uncooperative three year old where maintenance of dental wiring was difficult, and (4) one mildly infected open reduction incision. The average period of fixation required to achieve adequate clinical union was 30 days.

■ *Summary*

A study was made of 39 mandibular fractures in children. Problems peculiar to this age group must be considered, that is, growth and anatomic limitations involved, and rationale for therapy. Conservative treatment of condylar fractures is favored because of the danger of serious deformity that might result from surgical interference. Some form of dental wiring has proved effective in 90 per cent of the patients actively treated. In badly displaced body or angle fractures which do not respond to conservative methods, open reduction with direct interosseous wiring is the treatment of choice. In general, the principles governing the treatment of traumatic injuries to the lower jaw in adults are also applicable to children.

From the department of oral surgery, Charity Hospital of Louisiana at New Orleans.

*Resident in oral surgery, Charity Hospital of Louisiana.

†Formerly, resident in oral surgery, Charity Hospital.

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■ Genetics and Biochemistry

Modern research has thrown new light upon the age-old dispute over the relative importance of inheritance versus environment, of instinct versus learning. Every living organism, including man, has a genetic constitution which establishes and limits the potential for growth, differentiation and life span. Every manifestation of structure, function or behavior is determined by the interaction of the organism with its environment and becomes an essential element in each phase of growth, development and aging. These dramatic developments along with the new understanding of mutations which may be brought about by radiation have awakened a great interest in genetics, a discipline which will have a profound impact upon the whole field of reproduction, congenital anomalies, chemical as well as anatomical, and a wide range of clinical manifestations. The discovery that many diseases may be due to the genetically determined absence or reduction in amount of a single enzyme adds great importance to some new concepts of growth, physiology, infection and disease. The advances in biochemistry, in tissue culture, in electrophoresis and paper chromatography, combined with a knowledge of the principles of genetics, offer special opportunities not only for diagnosis and prevention but also for treatment. . . . Many diseases are in reality combinations of constitutional and environmental factors. Sometimes too much emphasis has been placed on the trigger mechanism of the environment and too little on the factors of inheritance and susceptibility. An understanding of certain disturbances in the human being is now possible through the application of recently acquired knowledge of enzymatic and biochemical processes.—*W. C. Rappleye. Science—Man's Master or Servant, 1959.*

Hospitalization of the dental patient requiring extensive treatment

■ *Richard J. Burch,* D.D.S., and Thomas S. Shuttee,† D.D.S., Lackland Air Force Base, Texas*

The use of hospital facilities for patients requiring extensive dental procedures at Lackland Air Force Base, Texas, and the emphasis on the necessity of observing the fundamental principles of surgery have enhanced the success of the treatment, especially in the prevention of postoperative complications. The advantages of hospitalization include: (1) control of fear; (2) better preoperative preparation and postoperative care; (3) economical utilization of time, both of the professional and of the patient, and (4) minimal postoperative complications.

With the continual influx of airmen into the Air Force for basic training, oral health problems are numerous and varied. During 1958, the dental processing unit examined 66,625 airmen, of whom 59,297 (89 per cent) were in need of dental treatment.

The oral health problems that typified the majority of airmen (54 per cent) were the elimination or treatment of abscesses, granulomas, cysts, tumors, acute and chronic infections, the removal of thousands of nonrestorable teeth, and the treatment of moderate to severe periodontal disease. The remaining 35 per cent needed restorative dentistry only. Statistics from previous years have been approximately the same. The correction of these conditions and the surgical preparation of the dental arches for a prosthesis require thousands of man hours at the professional and nonprofessional level.

To provide the best care and management in the treatment of the airmen and to prevent unnecessary loss of time from duty, the dental service uses the modern facilities of the United States Air Force Hospital, Lackland Air Force Base.

Although this report deals primarily with the hospitalization and management of the patient requiring oral surgery, specialists in periodontics and prosthodontics are making use of hospital facilities in the treatment of patients referred from other bases for specialized treatment in these fields.

Why should these patients be hospitalized? What are the advantages of managing them on an inpatient basis?

First, it is possible to control fear by the use of balanced anesthesia. Regard-

less of the outward manner of the most seasoned dental patients, they all inwardly experience varying degrees of fear when confronted with a dental procedure. This fear is extreme when the procedure involves surgery. The psychic trauma that many patients sustain when anticipating surgery or during the actual procedure is inestimable. This is particularly true of the airman taking basic training. He has been taken away from his normal environment, perhaps for the first time, and is entering a completely new way of life. In general, he is confused and bewildered, and many of the men actually are suppressing manifestations of frank hysteria. Many of these airmen have never had dental treatment of any type, and when suddenly confronted with a dental appointment their fear becomes extreme. In order to render the best care to these patients, elimination of this fear is paramount. At the time of this report, 7,000 dental patients in the hospital at Lackland Air Force Base have been administered balanced anesthesia consisting of intravenous secobarbital, morphine sulfate, and atropine sulfate followed by local anesthesia (lidocaine hydrochloride). A considerable decrease in syncope and fear reactions has been recorded.

Second, in the past it was customary, and at times necessary, for treatment of many dental conditions to be prolonged for weeks or even months, and for the patient to be subjected repeatedly to the fear and physical trauma during the entire therapeutic period. A complete mouth odontectomy may take as long as a year to be completed. This type of "piecemeal" treatment results in an unnecessary loss of man hours from duty and is not consistent with good patient management. Today, with improved surgical technics, training, and the use of hospital facilities and adequate balanced anesthesia, multiple or complete odontectomies with alveoloplasties can be accomplished in a single operation, thereby permitting the patient to return to full duty status in an average of from three to five days.

Third, it is possible to eliminate numerous postoperative complications by better preoperative preparation and postoperative care. The treatment of a military patient, whether or not an airman in basic training, presents many problems that the civilian practitioner encounters to a lesser degree. A great many of these persons are single, and consequently, without the advantages of home and family care. They live in barracks with approximately 70 other men. Their duties often are strenuous and their duty hours irregular. These conditions are not conducive to maintaining good oral hygiene or good postoperative care.

Fourth, the operation of the patient's squadron is enhanced. Hospitalization eliminates duty excuses, drastically reduces the need for reappointments, and permits the patient to receive special diets. Upon discharge from the hospital, the patient is returned to full duty status.

■ *Treatment Plan*

The following treatment plan is carried out for each patient admitted for multiple odontectomy:

Prior to admission for surgery, a thorough oral prophylaxis is given each patient by members of the periodontics department, and the importance of good oral hygiene is discussed.

On hospitalization by the oral surgery service, the patient is instructed regarding the necessity for good oral health. Many postoperative complications develop because of the patient's lack of knowledge and appreciation for preventive measures.

A detailed history is taken on admission. The patient's chief complaint, family history, and previous medical and dental history are completely reviewed. Knowledge gained by a thorough history of a patient is absolutely essential prior to treatment of the patient, and the value of this cannot be overemphasized.

PHYSICAL AND LABORATORY EXAMINATIONS—All patients admitted to the oral surgery service are carefully screened and evaluated prior to treatment. A complete physical examination of the patient is made by the oral surgery staff.

Routine laboratory examinations on patients admitted for odontectomy are not made at the time of admission to the oral surgery service at this hospital. After evaluating approximately 8,000 admissions and 250,000 outpatients by routine laboratory studies, that is, urinalysis, white blood cell count, serological tests, bleeding and clotting time, hematocrit examination, and so on, these procedures were discontinued on a routine basis both because of cost and lack of value. The majority of these laboratory tests had been performed at the time of the patient's enlistment in the Air Force. At present specific laboratory examinations are ordered only for patients whose history or physical examination indicate the need.

SEDATION AND ANESTHESIA—The patient is given a sedative with a barbiturate to insure a good night's rest. At the time of surgery the operating surgeon administers intravenous secobarbital sodium and morphine sulfate with atropine sulfate. This combination of drugs provides the psychic sedation needed for complete relaxation. In addition, this combination produces an antisialogogic effect, depresses the gag reflex, lowers the metabolic rate and induces analgesia; all of these results are especially desirable when oral procedures are to be carried out.

For the majority of patients, infiltration or block anesthesia or both are utilized. Block anesthesia, including second and third division trigeminal blocks, is used wherever possible because of the more profound anesthesia as well as the added advantage of making a smaller amount of drug necessary.

SURGICAL INTERVENTION—With few exceptions, all indicated surgery is accomplished in one procedure. This includes total and subtotal odontectomy, removal of impactions, cysts, and granulomas, alveoloplasty, treatment of soft tissue lesions, gingivectomies, and other similar procedures. Healing takes place simultaneously in all regions and permits early completion of treatment.

■ *Postoperative Care*

As soon as hemorrhage has been controlled, the patient is returned to bed. He is placed in a postanesthetic bed position with the head lowered for dependent oral drainage. All gauze packs are removed from his mouth. This reduces the danger of aspiration and allows the saliva and oozing blood to drain from the mouth. Ice packs are placed over the surgical

Table
Oral surgery liquid formula

Food	Measure	Carbohydrate	Protein	Fat	Calorie
Milk	1 qt.	48	32	90	1,130
Eggs	6		36	36	468
Ice cream	1 pint	60	8	36	596
Karo or honey	¼ cup	70			280
Casec (protein supplement)	1 oz.		20	3	107
Salt	1 teaspoon				
Vanilla to taste					
	1½ quarts	178	96	165	2,581
Three meals supplement the formula with		116	40	45	1,029
		294	136	210	3,610

The menu pattern is a modification of the soft diet with fruit juices, cereal gruel, soft cooked eggs, ground meats, mashed potatoes, pureed vegetables, ice cream, and cream puddings.

regions to reduce swelling. Because of sedation, the patient usually sleeps for four or five hours after surgery. As soon as he has reacted sufficiently, he is encouraged to take liquids and semisolids.

ORAL HYGIENE—Within 24 hours after surgery the patient is instructed to rinse his mouth hourly during the day and, when advisable, to begin brushing any remaining teeth with a very soft brush saturated in very hot water. A mixture of 50 per cent sodium chloride and 50 per cent sodium bicarbonate is used. This solution breaks the surface tension and helps to cleanse the oral cavity.

DIET—The patient's diet for the first 24 hours after surgery consists of fluids and semisolids. The most important food and the actual basis of his diet during hospitalization is an oral surgery formula (see table), which insures adequate nutritional intake and provides sufficient protein to promote rapid healing. Patients are instructed to consume a minimum of 1,000 cc. of this formula daily.

■ *Discussion*

The use of hospital facilities for patients requiring extensive dental procedures at Lackland Air Force Base, Texas, and the constant emphasis on the necessity of following the basic fundamental principles of surgery have greatly enhanced the success of the treatment, especially in the prevention of postoperative complications.

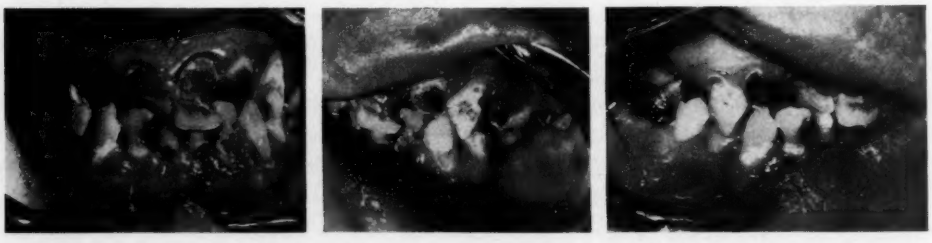
The utilization of antibiotics, either as prophylactic therapy or as routine postoperative medication, has been eliminated. Their use is the exception, and not the rule, being confined primarily to the treatment of acute cellulitis or phlegmons. The proper surgical management of circumscribed abscesses is far more effective, and if the infection is clearly localized, again no antibiotic therapy is utilized.

During a one year period only 31 instances of postoperative cellulitis occurred secondary to 43,343 surgical procedures (0.715 per 1,000). All of the 31 instances developed in patients who were treated originally on an outpatient basis.

Biometric data over a three year period reveal a total of 217 occurrences of postoperative hemorrhage in a total of 117,374 surgical interventions. This incidence is considered minimal in an oral surgery training center and may be attributed to strict observance of good surgical technic and proper care and management of the patient at the time of the original surgery.

In these 217 patients with secondary hemorrhage, the condition was arrested on initial treatment in 196 and 21 required hospitalization. It is a standing rule of the department chairman that all patients with secondary hemorrhages that are not thoroughly arrested at the initial attempt will be admitted to the hospital; also, if the patient exhibits extreme concurrent anxiety. This insures closer observation, adequate control of anxiety, proper diet, good nursing care during the acute episode, and the patient is available for further evaluation of the clotting mechanism. Of the 21 patients hospitalized, only one required the definitive systemic therapy of transfusion. This represents a ratio of 1 to 117,374, and fairly well establishes the rarity of the actual presence of true bleeding and clotting deficiencies which cannot be controlled by routine methods. The patients represented in this study were in all states of oral health and nutrition—from good to very poor; ages ranged from 18 to 70.

Further study of biometric data on postoperative secondary hemorrhage indicates the value of the better postoperative control and management obtained by the adjunctive aid provided by hospitalization. During a one year study there were 112 instances of postoperative secondary hemorrhage subsequent to 43,343 surgical procedures. Of this number only one instance of secondary hemorrhage was recorded for patients who were operated on initially while an inpatient. The ratio of inpatient patients to outpatients in this study was approximately 1 to 14—substantial evidence for the efficacy of hospital care as an aid in preventing the occurrence of secondary hemorrhage. This unusual clinical experience is very substantial evidence of the value of good surgical technic. This is true in relation to the original surgery as well as to any subsequent hemorrhage. It is poor judgment to rely on a drug or a combination of drugs which are of no proved value either as a preventive agent or in the actual treatment of the hemorrhage. No drug or combination of drugs



Typical dentition of thousands of airmen reporting to Lackland AFB for training

given systemically has been proved to affect favorably the bleeding or clotting mechanism. The possible single exception is vitamin K when used in treatment of the hemorrhagic disease of the newborn.

In summary the advantages of hospitalization are as follows: (1) control of fear; (2) postoperative care; (3) economical utilization of time, both of the professional and of the patient; (4) minimal postoperative complications.

The opinions or assertions contained herein are those of the authors and are not to be construed as official or as reflecting the view of the Department of the Air Force or the Air Service at large.

*Colonel, Dental Corps, U. S. Air Force; chairman, department of oral surgery, USAF Hospital, USAF Aerospace Medical Center (ATC), Lackland Air Force Base.

†Major, Dental Corps, U. S. Air Force; assistant to chairman, department of oral surgery, USAF Hospital, USAF Aerospace Medical Center (ATC), Lackland Air Force Base.

Hemangioma of the cavernous type associated with ameloblastoma (ameloblastic hemangioma)

■ *Victorino G. Villa, D.D.S., M.S.D., Manila, Philippines*

The specimen from an ameloblastic hemangioma reported here differed histologically from that reported by Aisenberg in 1950, particularly as to (1) the size of the capillaries, (2) the presence of keratinized ameloblastic cells adjacent to the capillaries, and (3) the tendency of the neighboring capillaries to coalesce with each other, thus forming larger cavities filled with blood elements. Surgical excision of such a tumor mass may give rise to severe hemorrhage.

In 1953, I reported an instance of ameloblastoma, evidently derived from the oral epithelium.[1] In the same report, I stated that the ameloblastoma was associated with extensive hemangioma. Observations on the portion of the tumor with hemangioma will be reported herein.

Bernier[2] has stated that ameloblastic hemangioma occurs rarely. In our laboratory, we have encountered only two instances including the one under consideration. The first one was reported on in 1955.[3] There are certain problems involved in the treatment of ameloblastic hemangioma. As will be shown later, surgical excision of the tumor mass may give rise to severe hemorrhage.

■ *Examination of Specimen*

A surgical specimen was taken which consisted of a complete section of an edentulous lower jaw from the angle to the region of the cuspid. This portion of the jaw was resected because of a neoplastic growth that was ulcerative, particularly in the molar region. A part of the specimen was sectioned buccolingually. Figure 1 shows an area of the tumor mass free from hemangioma. It may be noted that the ameloblastic cells

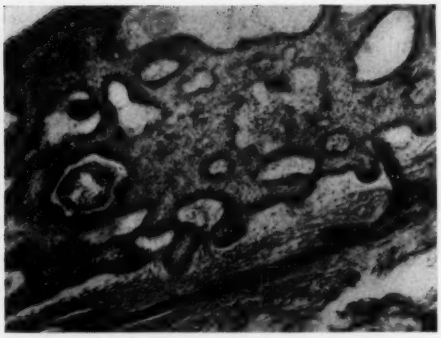


Figure 1

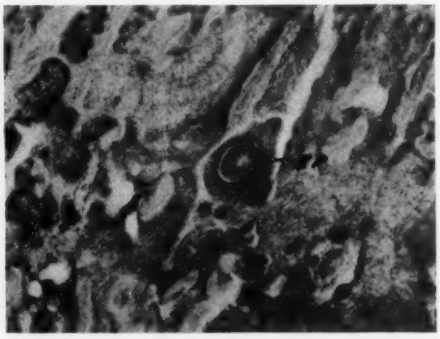


Figure 2

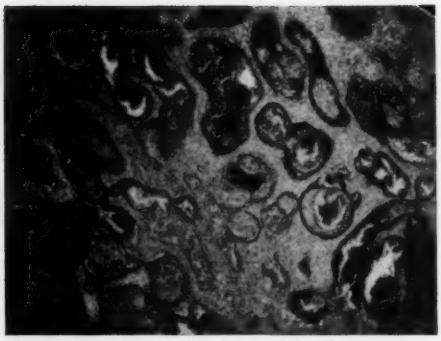


Figure 3

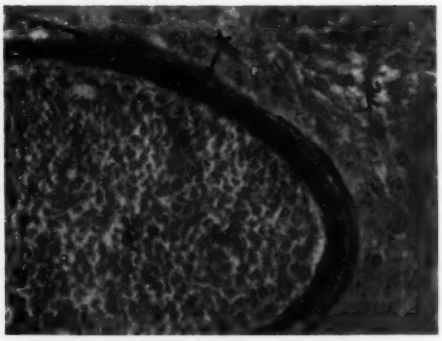


Figure 4

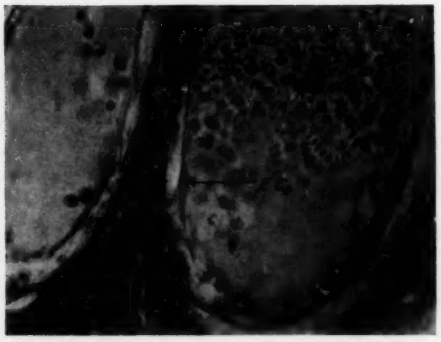


Figure 5

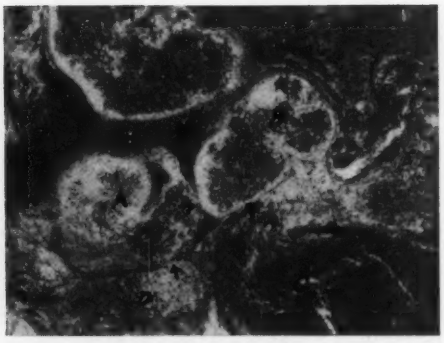


Figure 6

are arranged in a plexiform pattern with the cuboid epithelium at the periphery of the epithelial sprouts and with the stellate reticulum at the center. Some of the tumor mass contained epithelial pearl (Fig. 2). In another area of the tumor mass there were several blood capillaries filled with red cells (Fig. 3). The capillaries appeared to have relatively thick vessel walls. On higher magnification, however, (Fig. 4) the structure resembling a vessel wall was seen to be a degenerated and keratinized portion of the ameloblastic cells. Figure 5 shows a portion of two neighboring capillaries separated by a strand of the ameloblastic cells. There appear to be early degeneration and keratinization of the ameloblastic cells adjacent to the capillaries. We have observed the tendency of the capillaries to coalesce with each other after the degeneration of the intervening strands of ameloblastic cells and the endothelium as indicated by the arrows in Figure 6. In fact, it may be noticed that capillary "C" has already ruptured at the point marked "X" and has coalesced with capillary "E." It seems evident that this cavernous type of hemangioma associated with ameloblastoma is due not only to the unusually large size of the lumen of the capillaries but also to their tendency to coalesce with each other, thus forming larger cavities filled with blood plasma and red cells.

Fig. 1—Portion of tumor free from hemangioma. Note ameloblastic cells arranged in plexiform pattern

Fig. 2—Another portion of tumor showing some of the masses of ameloblastic cells containing epithelial pearl, EP

Fig. 3—Portion of tumor showing several unusually large blood capillaries. Most of them are filled with red cells. Note apparently thick vessel wall. Between these capillaries, ameloblastic tumor cells are present

Fig. 4—Higher magnification of one blood capillary filled with red blood cells. It may be noticed that ameloblastic tumor cells adjacent to vessel are degenerated and keratinized, K; RC, red blood cells; TC, ameloblastic tumor cells

Fig. 5—Higher magnification of portion of two neighboring capillaries separated by strand of ameloblastic tumor cells. Early degeneration of tumor cells adjacent to capillaries marked x can be noted. RC, red blood cells; EC, endothelial cells; TC, ameloblastic tumor cells

Fig. 6—Higher magnification of neighboring capillaries marked A, B, C, D and E respectively. Tendency can be seen of the capillaries to coalesce with each other at points marked by arrows. Capillary C has already ruptured at point marked x and coalesced with capillary E

■ *Comment*

The specimen from the ameloblastic hemangioma reported here presented a different histological picture from that reported on by Aisenberg[4] in 1950, particularly as to the size of the capillaries, the presence of keratinized ameloblastic cells adjacent to the capillaries, and the tendency of the neighboring capillaries to coalesce with each other, thus forming larger cavities filled with blood elements. This condition of the tumor may give rise to a severe hemorrhage as a complication during surgical operation.

*Department of oral histology and pathology, College of Dentistry, University of the Philippines, Manila.

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Central fibroma of mandible: *report of case*

■ *Richard J. Burch,* D.D.S., Lackland Air Force Base, Texas, and Hubert W. Woodward,† D.D.S., San Antonio, Texas*

The infrequent occurrence of central fibroma of the mandible is evidenced by the scarcity of case reports. Thoma[1] attributes the rarity of this tumor partly to its tendency to form osseous structures and to develop into a fibro-osteoma before being recognized. Central fibromas of the mandible arise intraosseously. Their etiology is obscure. It is believed that they can be formed from retained embryonic connective tissue cell, the perineural sheath, or from the mesenchymal part of the tooth germ.

HISTOPATHOLOGY[2]—Calcification and bone formation often occur, particularly with age. Such reactions may tend to localize about regions of greater vascularity. The bulk of the mass is composed of interlacing and intertwining bundles of collagen fibers. Cellular content decreases with age, as do cell size and activity. Even in the younger, more cellular lesions, mitoses are rare, an index of its slow growth. Inflammation is not normally a feature, unless occurring secondarily.

CLINICAL AND ROENTGENOGRAPHIC FINDINGS—The mandible is involved more frequently than the maxilla, and both subjective and objective symptoms are rare. The main symptom is swelling, and rarely is pain a prominent feature. Loss of sensation is also rare. On palpation there is a lack of fluctuation or crepitation, which usually will differentiate this lesion from a cyst. The overlying mucosa is normal in color, texture, and consistency, and shows no reaction to the underlying growth.

Roentgenographically, the central fibroma is a radiolucent lesion which has a well defined margin but may appear to present some trabeculation. Otherwise it has no characteristic appearance.

TREATMENT—Excision of a central fibroma should be conservative. Generally the tumor can be enucleated easily and usually it will not recur; however recurrences must be watched for because they have been reported[3] with later development of fibrosarcoma.

REPORT OF CASE—The patient, a 14 year old white girl, was admitted to the oral surgery service of the 3700th USAF Hospital, Lackland Air Force Base, Texas, on March 11, 1957, for treatment of a lesion in the body of the mandible on the right side which had previously been diagnosed as fibrosarcoma.

HISTORY—The patient brought with her the following case summary. The history of present illness dated from February 3, 1957, at which time the patient had reported to the

dental service of an Air Force hospital with a complaint of paresthesia of the right side of the lower lip with slight tenderness over the right side of mandible. There was no history of trauma or pain.

Roentgenographic examination revealed a radiolucent lesion of the body of the mandible on the right side which extended from the second bicuspid to the angle of mandible with resorption of the roots of the first molar. There was gross bone destruction with no sharply demarcated border, and the over-all contour showed irregular mottling (Fig. 1).

On February 26, 1957, the patient was admitted to an Air Force Hospital and on the following day, an excisional biopsy, including extraction of the first, second, and third molars was done under local anesthesia by the members of the oral surgery service. The specimen, including the teeth, was sent to a histopathology center for microscopic examination.

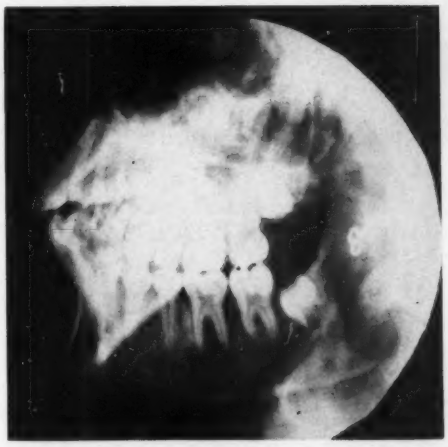

Fig. 1—Preoperative view. Note irregular mottling, first molar root resorption and lack of demarcated border

PATHOLOGIST'S REPORT—The pathologist reported that the sections consisted of rather dense fibrous tissue. The tumor tissue was fairly cellular. For the most part, the tumor cells were forming tangled bundles of fairly mature collagen fibers. In other places, however, the stroma was somewhat myxomatous and here the tumor cells were stellate in outline. The tumor cells were fairly uniform and had ovoid, rather vesicular nuclei. There was little pleomorphism present and no mitotic figures were seen (Fig. 2, left). In one of the sections, the tumor cells apparently were forming osteoid and bone. This section was the most disturbing in that the tumor tissue was infiltrating skeletal muscle (Fig. 2, right).

This tumor was diagnosed as malignant, primarily on the basis of its behavior and its invasion of the skeletal muscle. It was felt that the tumor was a locally aggressive tumor but that the probabilities are that it would not metastasize. The slides were sent to the Armed Forces Institute of Pathology for consultation. The diagnosis was fibrosarcoma, low grade, incompletely excised.

The patient was then transferred to the USAF Hospital, Lackland, for further treatment.

EXAMINATION—When first seen on March 11, 1957, the patient appeared to be in no acute distress. Her blood pressure was 128/78, pulse 76, respirations 20, and temperature 99. The physical examination showed everything was within normal limits except for an open wound in the posterior body of mandible on the right side, the site of recent biopsy. The wound appeared to be healing normally. The external aspect of the mandible was not involved. There was no extension into the soft tissue, although there was a palpable induration immediately lingual to the point of biopsy.

Examination of the neck revealed no lymphadenopathy or palpable masses. The past history and systemic review were negative and noncontributory. Laboratory studies were negative or within normal limits.

Roentgenographic examination of the mandible showed the postoperative site of the excisional biopsy, extending from the right second bicuspid to the angle of the mandible (Fig. 3, left).

The case was presented to the tumor board on March 14, by the oral surgery service for further confirmation of diagnosis and recommended treatment plan. There was considerable difference of opinion among the members

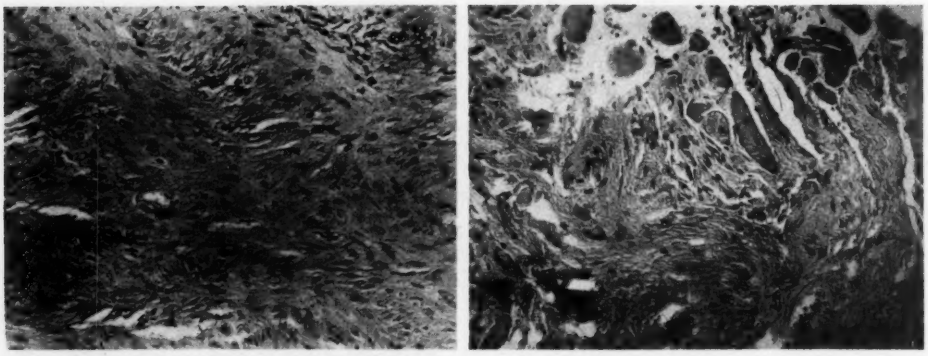

Fig. 2—Left: Section showing tumor cells which are fairly uniform and forming tangled bundles of collagen fibers. Right: Section showing what was described as tumor tissue invading skeletal muscle

of the board as to whether this was a malignant lesion. Many differential diagnoses were mentioned and discussed in reference to the clinical, roentgenographic and pathological evidence; for example: (1) lack of pain, (2) paresthesia, (3) lack of expansion of bone, (4) normal postoperative healing, (5) irregular mottled destruction of bone, (6) resorption of molar root, (7) no sharply demarcated border, (8) questionable muscle invasion, (9) no mitotic figures, (10) similarity of cells, and (11) islands of bone.

The tumor board agreed that the diagnosis of fibrosarcoma was equivocal and no treatment should be instituted until further consultation with a histopathology center.

The patient was discharged from the hospital on March 15 to await the report from

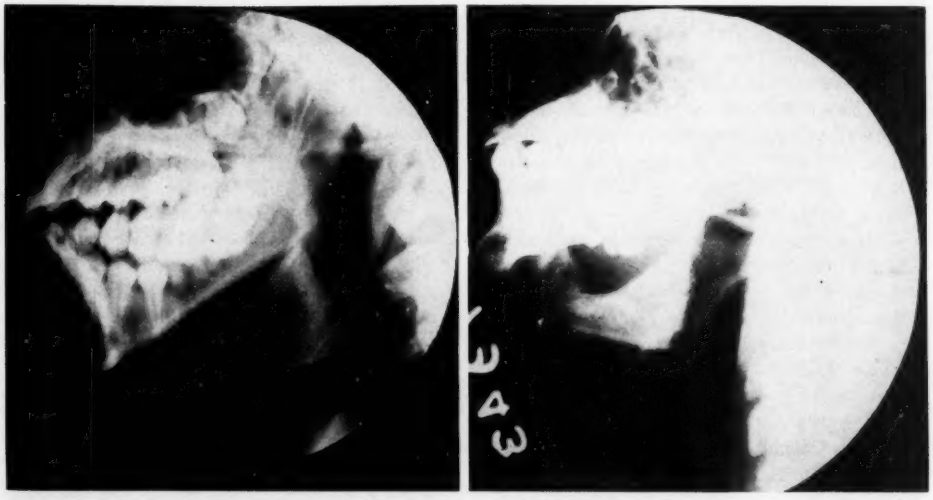

Fig. 3—Left: Immediate postoperative view showing extent of mandibular lesion. Right: One year postoperatively. Bone defect with regenerating bone

this center. On March 16 the following report was received:

"The staff feels that the tumor is perhaps best classified as a central fibroma of the mandible. Its cellularity is marked, but we have seen this in fibromas arising from odontogenic mesenchyme."

The diagnosis was then changed to central fibroma and because of the wide excisional biopsy performed, no other surgical intervention was deemed necessary or advisable; therefore, the patient was not readmitted to the hospital.

This case has been reviewed by the tumor board on four occasions as a follow-up, and when the patient was last seen on January 16, 1958, the oral lesions had cleared up completely, the mucosa was normal, and the paresthesia was no longer present. Roentgenograms indicated the bone defect was regenerating satisfactorily (Fig. 3, right).

The tumor board recommended that the patient be seen at six month intervals.

COMMENT—The case reported herein presents interesting problems in differential diagnosis, and illustrates the necessity of careful evaluation of all available evidence prior to any radical treatment.

There should be no hesitation about using additional histopathological consultation when any diagnosis is equivocal, especially if the diagnosis indicates a malignant growth which would require radical surgery. If this is done it may help, as in this instance, to avert a possible drastic and irreversible mistake.

SUMMARY—A 14 year old girl came for treatment of a rare benign lesion of the body of mandible on the right side which had been equivocally diagnosed, from excisional biopsy, as fibrosarcoma. This diagnosis was changed to central fibroma after thorough evaluation by the tumor board and histopathological consultation.

The patient has been followed closely for three years. Recovery has been uneventful and no signs of recurrence are evident.

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*Colonel, Dental Corps, U. S. Air Force; chairman, department of oral surgery, USAF Hospital, USAF Aerospace Medical Center (ATC), Lackland Air Force Base.

†Major, Dental Corps, U. S. Air Force; resident, oral surgery, 3700th USAF Hospital.

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■ Creative Science

There can be little question that our universities have had a substantial expansion in science courses. But I am not sure that this increase in emphasis is resulting in a proportionate increase in creative scientists; that is, scientists who know how to work with theory and who are capable of fresh conceptual thought. The impression I have is that we are turning out good technicians and engineers, but not necessarily original thinkers who have an urge to probe on the frontiers of scientific progress.—*Norman Cousins. Stroll on the American Campus, Saturday Review, April 30, 1960.*

Conservative treatment of teeth involved in a cystic ameloblastoma: *report of a case*

■ *Lloyd E. Church,* D.D.S., Ph.D., Bethesda, Md.*

The following case is reported to show the destructive process of pressure on teeth and bone and the regenerative capacity of bone, and to illustrate a conservative method of treatment of teeth involved in an ameloblastoma.

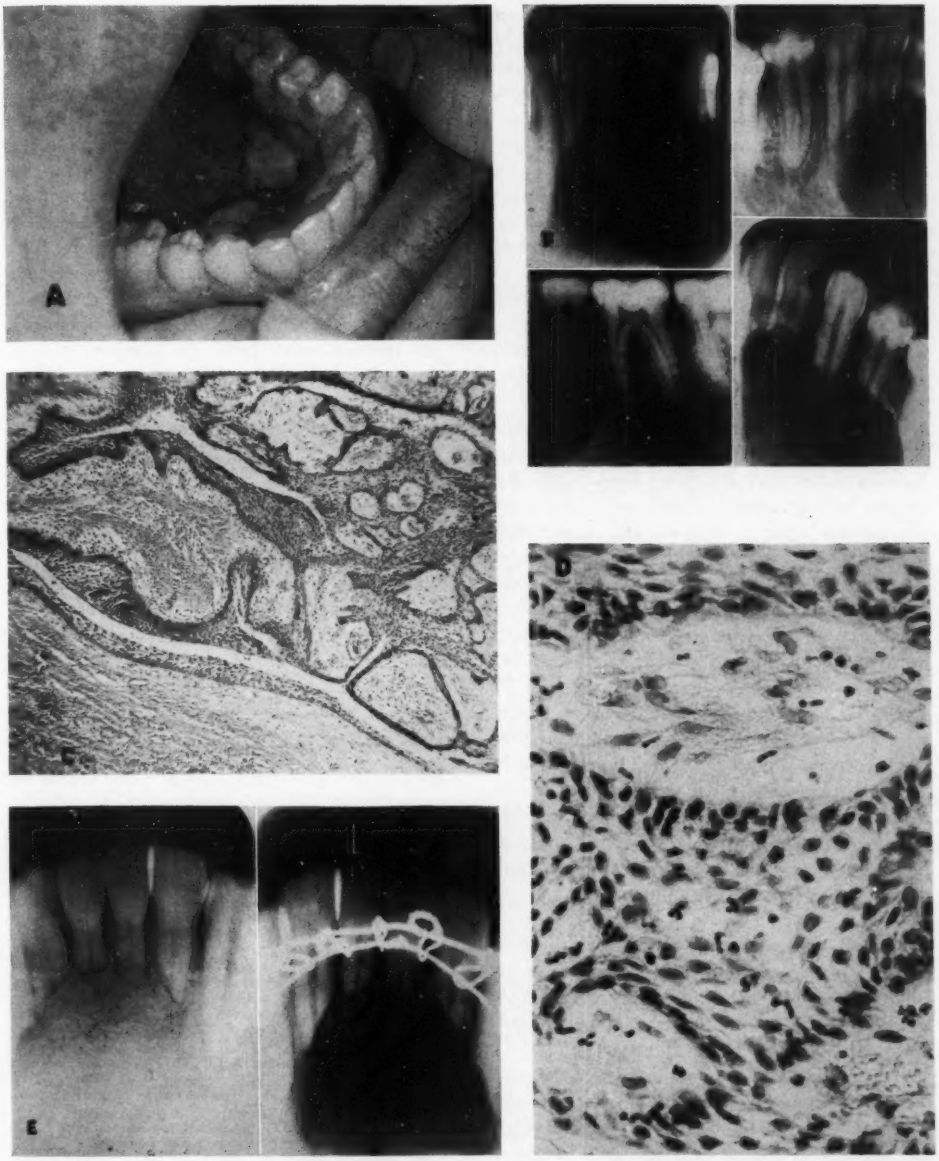
HISTORY—A 17 year old boy was first seen June 3, 1957, with a chief complaint of a loose lower central incisor. The past history and family history were noncontributory.

CLINICAL AND ROENTGENOGRAPHIC EXAMINATION—The patient was in normal physical condition except for the lesion involving the mandible. Clinical examination revealed the teeth to be in good alignment. A bulge of the lingual bone was noted in the anterior region (see illustration, A). Roentgenograms of the mandible revealed a large, cystlike area extending from the lower right second bicuspid across the midline to involve the lower left first bicuspid. The roots of all anterior and bicuspid teeth were stripped of bony support, and some roots were irregularly resorbed (illustration, B). All teeth responded to vitality tests of hot and cold.

OPERATIVE PROCEDURE—The lesion was removed at Suburban Hospital, Bethesda, Md., on June 4 while the patient was under general anesthesia. With the use of 24 gauge stainless steel wire, all involved teeth were stabilized. An incision was next made in the gingival sulcus from the right first molar continuing to the lower left first molar and the gingiva retracted up toward the incisal edge of the teeth. The growth was exposed and, where necessary, thin shell-like fragments of bone were removed. The growth was enucleated completely, and the exposed roots of all teeth were curetted. A soft rubber drain was inserted in the cystic area and sutured into place. The entire incision was closed with no. 000 black silk sutures.

PATHOLOGY REPORT—The specimen consisted of a mass measuring 4.0 by 2.5 by 2.0 cm. The wall was thick and nontranslucent, and on sectioning, was found to contain several daughter cysts which did not communicate. The linings of the cysts were generally smooth, although papillary projections were present in each area (illustration, C). In the more solid areas, these papillary projections were grayish-white.

The microscopic examination revealed that this was a cystic ameloblastoma, but much more complicated than the ordinary follicular cyst. The bulk of the wall was composed of collagenous fibrous tissue varying somewhat in thickness. On the lining surface there was epithelium, but not completely of a squamous type. In some areas, the epithelium retained odontoid characteristics, with an outer layer of more solid cells and central cells suggesting the stellate reticulum type (illustration, D). The surrounding stroma was rather edematous



A: View showing bulging of lingual bone in anterior region. B: Views illustrating extent of lesion and resorption of roots. C: High power view of papillary projections and multiple cystic areas. D: High power view showing combination of reticular cells and edematous and vascular epithelium. E: At right, teeth before removal of lesion, with stabilizing wires in place, and, at left, after removal of wires, with area completely replaced with bone

and vascular, suggesting the pulp type. There was no evidence of dentin formation. In the outer portion of this fibrous capsule there was a layer of osteoid that seemed to have developed in the fibrous tissue and was entirely independent of the mandibular bone. This lesion had to be interpreted as more than a simple follicular cyst, and yet it was scarcely a well-differentiated ameloblastoma. The report stated that the prognosis had to be somewhat indefinite, although the condition was not as likely to recur or be invasive as a well-differentiated ameloblastoma.

The diagnosis was cystic ameloblastoma, with terminal cystic change.

CLINICAL COURSE—No attempt was made to limit activities of the patient except to put him on a soft diet for three days. Since the patient was a football player and insisted on playing his sport, a separate full upper and lower sponge rubber mouthguard was made. The sutures were removed on the fourth postoperative day. The rubber drain was removed on the tenth postoperative day, and gauze dressings were replaced weekly for six weeks. The patient was seen monthly until July 8, 1958, a year and one month later, at which time all wires were removed. The patient was last seen April 28, 1959. At this time no swelling or looseness of teeth was noted, and all teeth responded to vitality tests of hot and cold. Roentgenograms in April 1959 revealed normal filling in of bone in the cystic area and around roots of all involved teeth (illustration, E).

DISCUSSION—It is not the purpose of this paper to discuss the classification of cysts or of ameloblastomas. This has been accomplished by Bernier,[1] Bernier and Ash,[2] Ballenger,[3] Lederer,[4] Robinson,[5-8] and Thoma.[9]

The treatment of cystlike lesions varies not only with the capabilities of the surgeon, but also with the individual problems involving the lesion itself, such as size, location, structures involved, infection and condition of the patient.

The author has used all types of bone to fill cavities, with varied results. In the present case no bone of any kind was used to fill the cystic area, in order to ascertain the regenerative capacity of an area this large and the condition of the teeth when bone regeneration was completed around the roots.

The regenerative capacity of bone should never be overlooked when removing lesions of this type, even when an entire root or multiple roots are denuded of bone. Bone regeneration in this case was complete, even to formation of what appeared to be a lamina dura. By making an incision away from the gingival margin, leaving the gingival attachment intact, and supporting the teeth by stabilization, it was possible to preserve an extremely active area of periosteum around the cervical portion of the teeth.

SUMMARY—An unusual case is reported of a cystic ameloblastoma involving multiple roots in varying degrees of resorption. All teeth responded to vitality tests of hot and cold both before the operation and at the time of the patient's dismissal. The teeth were stabilized instead of removed, and the gingival attachment was left intact by making the incision in the gingival sulcus and retracting it toward the incisal edge of the teeth.—*8218 Wisconsin Ave.*

*Clinical instructor in anatomy, George Washington University School of Medicine; attending oral surgeon, Suburban Hospital, Bethesda, Md., and staff member, department of oral pathology, Armed Forces Institute of Pathology, Washington, D. C.

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Otalgia caused by a broken needle in the pterygomandibular space: *report of case*

■ *Frederick T. Wigand,* D.D.S., M.S., Jacksonville, Fla.*

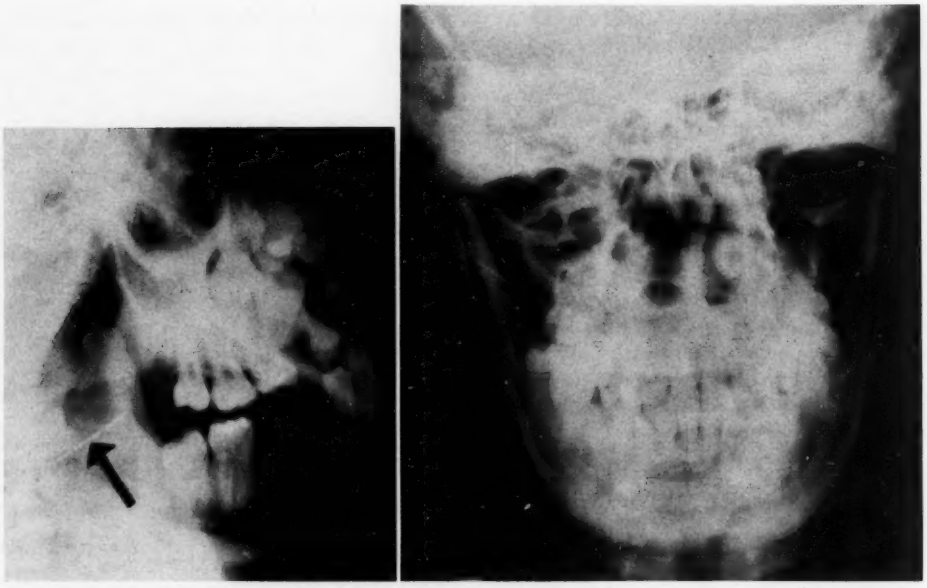
The problem of referred pain is of considerable concern to the dentist. When pain arises at one point and is perceived by the patient at another point, the phenomenon is alluded to as referred pain. In the case to be reported, the pain receptors in and about the pterygomandibular space were irritated, but the symptoms were referred to the ear.

HISTORY—A 22 year old sailor was referred to the U. S. Naval Hospital by the medical officer of the cruiser Prat, Chilean navy. The patient complained of pain and deafness involving his right ear. Examination by the otolaryngologist revealed no inflammation and no perforation of the tympanic membrane. The patient was referred for a dental examination.

EXAMINATION—Intraoral examination revealed normal mucous membrane, recent extraction wounds at the site of the second bicuspid and the first molar on the right side of the mandible and a partially erupted lower right third molar. Intraoral roentgenograms were negative except for the extraction wounds and several teeth with incipient caries. Extraoral roentgenograms taken from the lateral and posteroanterior aspects (see illustration) demonstrated the presence of a broken needle in the pterygomandibular region of the right ramus of the mandible. Interrogation of the patient elicited the information that the needle had been broken five years previously and no attempt had been made to remove it. Removal of the needle was advised.

OPERATION—Local anesthesia was induced with 2 per cent procaine and epinephrine 1:50,000. An intraoral vertical incision 3 cm. in length was made in the mucous membrane approximately 2 cm. distal to the anterior border of the ramus of the mandible and 1 cm. superior to the occlusal surface of the lower molars. The wound edges were retracted, and with care to avoid injury to the lingual nerve, blunt dissection was used to disclose the needle. The needle was grasped with a hemostat and manipulated through the soft tissue so that it followed approximately the course of its initial insertion. When it emerged from the mucous membrane into the mouth, it was grasped with a second hemostat and removed. The needle was not eroded but was badly tarnished, having a dark gunmetal color. The incision was closed with interrupted silk sutures.

COURSE—Because of the simplicity of the operation, hospitalization of the patient was not deemed necessary. He was returned to his ship with instructions to return the following day for postoperative observation. Examination of the wound on his return revealed a slight amount of edema at the site. There was no trismus, and the incision appeared to be healing satisfactorily. Sutures were removed on the



Lateral and posteroanterior views showing broken needle in pterygomandibular space

fourth postoperative day. The patient was seen for the last time two weeks after the removal of the broken needle. The auricular symptoms of which the patient had previously complained were no longer present. It was assumed that the removal of the broken needle had eliminated the cause of his otalgia.

DISCUSSION—In the case reported, the patient complained of pain in the ear; however, there was no sign of aural disease. The situation is an example of referred pain in the distribution of the trigeminal nerve. The etiological factor causing the referred pain was the presence of a broken hypodermic needle in the pterygomandibular space. The needle apparently created a mechanical stimulus of sufficient intensity in the inferior alveolar nerve to develop a nerve impulse of pain. Because of the relations of the trigeminal nerve to the facial nerve, pain in the inferior alveolar nerve possibly was referred to the ear by way of the tympanic branch, since the inferior alveolar nerve communicates through the auriculotemporal nerve with the nerves of the external auditory meatus, from which the tympanic branch passes to the tympanic membrane.

COMMENT—A case is reported in which a broken needle in the pterygomandibular space was responsible for referred pain to the ear. In addition to being an example of referred pain in the distribution of the trigeminal nerve, the case illustrates the value of taking more than routine intraoral roentgenograms when making a complete dental examination. Had not extraoral roentgenograms been taken in the case reported, detection and removal of the broken needle would not have been accomplished, and the patient would have continued to suffer from otalgia.

The opinions or assertions contained in this article are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

*Captain, Dental Corps, U. S. Navy. Chief of dental service, U. S. Naval Hospital.

■ THE SURGICAL TREATMENT OF FACIAL INJURIES. By Varaztad H. Kazanjian, D.M.D., M.D., and John M. Converse, M.D. Second edition. 1070 pages with 1155 illustrations. Index and Bibliography. $22. The Williams & Wilkins Co., Baltimore, 1959.

The second edition, as was the first, is a thorough coverage of the author's experience in the field of facial injuries. This experience, especially that of the senior author, is vast, and extends from World War I to the present day.

Six new chapters have been added: "Introduction to Fractures of the Facial Bones"; "Fractures of the Fronto-Ethmoidal Region and Traumatic Cerebrospinal Rhinorrhea"; "Facial Injuries in Children"; "Roentgen Examination of the Facial Bones"; "The Transplantation of Tissues"; and "Scars of the Face." Many of the previous chapters have been expanded and brought up to date. The jaws and dentition are considered, and a section is included on prosthetic and surgical facial reconstruction. Also included is a thorough review of tissue transplantation.

Throughout the text, the dental and oral surgical background of the senior author is demonstrated outstandingly. This feature illustrates the desirability of such a background for either the dentist or physician who plans to treat maxillofacial injuries.

This book encompasses many sub-specialties, and would be a valuable addition to the library of the oral surgeon, prosthodontist, ophthalmologist, otolaryngologist, neurosurgeon, general surgeon and plastic surgeon.

The style is pleasantly relaxing and the content is well balanced between basic surgical principles and case reports to demonstrate practical application of these principles.—*James B. Edwards.*

■ PRINCIPLES OF CLEFT PALATE PROSTHESIS. By Cloyd S. Harkins. 219 pages with 249 illustrations. Index. $12.50. New York, Columbia University Press, 1960.

The publishing of this new volume by Dr. Harkins is an event of major importance to dentists concerned with the prosthetic aspect of the rehabilitation of the cleft palate patient. Since previous books dealing with the subject are out of date, the author has attempted to describe step by step procedures and technics and to present the most modern concepts in this vital field.

Dr. Harkins is a man of no little experience in cleft palate rehabilitation. He has spent 42 years in the study and treatment of individuals with this deformity. He is the director of the Cleft Palate Diagnostic Clinic of the Philipsburg State Hospital, Philipsburg, Pa., and is consultant to hospitals in Philadelphia and Pittsburgh.

This book is of interest to all members of the team of physicians, dentists, and lay personnel who aid in the treatment of the cleft palate patient. However, the prosthodontist, oral surgeon, speech therapist and plastic surgeon should benefit most from the clear and concise descriptions of the author.

The pages are generously endowed with over 200 photographs and illustrations, the quality of which is excellent throughout.

Also included is an excellent chapter dealing with acquired clefts of the palate caused by various types of injuries, diseases or tumors. An acquired palatal cleft seriously affects mastication, speech and deglutition and in an ideal situation, the prosthesis should be constructed before surgery. It then may be inserted as soon as possible and may be modified later or a new prosthesis constructed. In this way it main-

tains function, keeps the dressing free of contamination and is psychologically better for the patient.

There are chapters on corrective surgery to assist the prosthesis and one on construction of expansion prostheses for infants with bilateral cleft lip and cleft palate.

An excellent section is devoted to speech therapy and rehabilitation programs.

This book is an example of the many years of hard work so generously devoted to the cause of rehabilitation of these unfortunate patients by Dr. Harkins and men like him. It is well written and is highly recommended for those interested in the field.—*David L. Ford.*

■ THE METABOLISM OF ORAL TISSUES. Edited by O. v. St. Whitelock. Annals of the New York Academy of Science, Vol. 85, Art. 1. 499 pages. New York, New York Academy of Sciences, 1960.

This monograph consists of 33 papers and is a result of the conference on the metabolism of oral tissues held by the New York Academy of Sciences on October 15, 16 and 17, 1959. The papers represent the work of diverse disciplines and demonstrate the advances made in understanding the evolution, structure and function of the oral tissues.

The contents are arranged under five subheads. The first part, "Perspectives on Oral Tissue Metabolism," contains papers which consider the oral tissues from the broad aspects of evolution, genetics, anthropology, nutrition and local intraoral factors. The balance of the material is concerned with specific components of the oral cavity. The parts are entitled "Tooth Tissues," "Salivary Glands," "Tongue and Oral Mucosa," and "Periodontal Tissues."

Although this volume contains a wealth of information, it is not an exhaustive review and should be regarded more as a profile of present progress. Unfortunately, in some instances, the illustrations are removed from the text descriptions making it necessary to turn pages back and forth in order to relate the material. Aside from this occasional annoyance, the book is well organized. Its contents, appealing to diversified groups, should stimulate thought and incite research in many areas. Perusal of this comprehensive monograph should enable one to gain a broad perspective of the current concepts concerning the oral tissues.—*William K. Elwood.*

■ NEW AND NONOFFICIAL DRUGS 1960. By Council on Drugs, American Medical Association. 768 pages. $3.35. Philadelphia, J. B. Lippincott Co., 1960.

This book, an annual publication of the Council on Drugs of the American Medical Association, contains descriptions of the newer preparations in the form of monographs which evaluate the drugs on the basis of the laboratory and clinical evidence available. It contains agents proposed for use in the treatment of disease whether or not their usefulness has been definitely established.

New and Nonofficial Drugs is limited to drugs which are commercially available in the United States that have not been included in the *United States Pharmacopeia, National Formulary,* or *New and Nonofficial Drugs* for a prior cumulative period of 20 years. Several drugs have been omitted from the new edition because they are no longer commercially available in the United States or because of their inclusion in the USP, NF or NND for a 20 year period.

The monographs are concise and informative without being too brief and include nonproprietary as well as commercial names, chemical identity, properties, actions and uses, comparisons with related drugs, side effects, toxicity, contraindications, dosage and routes of administration, and the various preparations.

The drugs are grouped according to their specific purpose such as acute infectives, autonomic drugs, gastrointestinal agents, and so on. One of the weak points of the book seems to be the lack of an adequate cross-indexing system.

New agents included in the 1960 edition of interest to the oral surgeon are halothane, triamcinolone, chloroprocaine hydrochloride,

triflupromazine hydrochloride, vancomycin hydrochloride and many others. However, some new preparations such as carbocaine and methohexital sodium are not included.

The cost of this book is slight indeed compared with the wealth of information which it provides. In these days when the field of pharmacology is changing so rapidly, it behooves the practitioner to keep abreast of the times.

This volume is extremely readable and practical in its approach and is highly recommended for use as a yearly supplement to one of the standard pharmacology texts.—*David L. Ford.*

■ Oral Anatomy. By Harry Sicher. 514 pages with 314 illustrations. Index. Third edition. $13.50. St. Louis, C. V. Mosby Co., 1960.

This is a textbook on descriptive, regional and applied oral anatomy. It is designed to supplement the textbooks on dental and human anatomy and is oriented toward the interests of the dentist and oral surgeon.

Many changes are noted in this edition as compared to the 1952 second edition. The terminology approved in 1955 by the International Nomenclature Committee is incorporated into the new edition, and in instances where the approved name is new, the older term is given in parentheses. Furthermore, numerous sentences and paragraphs have been altered and rearranged to present the material in a clearer, more concise manner. The greatest modifications are found in the sections describing the growth of the skull, the anatomy of the temporomandibular articulation, the functional disturbances of the temporomandibular articulation and the movements and positions of the mandible. The accumulation of knowledge in these areas has rendered inadequate the information presented in the older edition. Also, by the inclusion of the musculus depressor supercilli in the third edition, four rather than three muscles of the eyelids and eyebrows are described. On the other hand, the function of the musculus nasalis is deleted and the description of the musculus dilator naris is expunged completely.

The illustrations in the new edition are the same as in the former one, except for the addition of five photomicrographs in the chapter on the skull and the replacement of the semidiagrammatic representation of the regions of origin of the muscles of facial expression by another figure. Also, a table of the parasympathetic ganglia associated with the trigeminal nerve is added.

The printing layout is more pleasing in the third edition. Locating information on specific subjects has been greatly facilitated by the use of bold type instead of italics to introduce the anatomic component to be discussed.

The third edition of *Oral Anatomy* supersedes the second edition in its fidelity to current knowledge, clarity of presentation and printing plan. Certainly, this book should prove serviceable and gratifying to all persons interested in oral anatomy.—*W. K. Elwood.*

■ EXPERIENCES WITH MINIMAL WOUND DRESSINGS FOLLOWING HEAD AND NECK SURGERY. Robert G. Chambers, M.D. Surgery 46:982 Nov. 1959.

Surgeons constantly are searching for more effective methods of dressing wounds. It long has been the custom after extensive surgery about the head and neck to apply large bulky compressive dressings which usually are extremely uncomfortable for the patient, and quite often interfere with wound healing because of maceration of the underlying skin and constant saturation from wound secretions. After extensive surgery about the neck and head, particularly when the mouth must be entered in continuity, a tracheostomy is necessary in the immediate postoperative period. The management of this tracheostomy is made doubly difficult during this postoperative period when large bulky dressings are applied. Frequent changes of dressings increase the patient's discomfort and can easily interfere with adequate immobilization of areas recently grafted with skin.

The authors report the experience of using constant suction applied beneath the skin flaps in place of compression dressings in 418 cases. After the completion of the neck dissection or neck part of a composite operation, two multiple perforated no. 16 or no. 18 French rubber catheters of appropriate length are inserted through separate stab wounds and tunneled beneath the skin in the infraclavicular region. The stab wounds usually are placed on each side of the vertical incision. The tip of one catheter is directed upward to rest in the region of the mastoid, the other assumed a more medial course to rest in either the submental region or the opposite mastoid region. The catheters are sutured in place loosely. The skin flaps are closed in the usual manner and the skin edges washed with ether, collodion or some of the new plastic sprays such as Aeroplast. One thin film of narrow mesh gauze then is applied immediately over the skin incisions and collodion or plastic again applied. Suction is maintained on the average from 36 to 72 hours. At the end of 36 hours, the suction tubes are clamped and suction is discontinued for six hours at which time suction is again established and the accumulation of material in the suction receptacle carefully measured. If there are no more than a few cubic centimeters, the suction tubes are removed and the stab wounds covered with small Band-aids. If the accumulation of serum is more than a few cubic centimeters, suction is re-established for another 36 hours.

Experience indicates that this method is satisfactory in all respects and the instance of complications is no greater than with older tried and true multi-gauze dressings. This cannot be attributed to the suction itself. This form of wound dressing is much more comfortable for the patient and allows the maximum of motion and mobilization without significant effects.—*Myron Kaufman.*

■ ANATOMICAL CONSIDERATION IN THE SURGICAL MANAGEMENT OF THE CLEFT MUSCULAR VELOPHARYNX. James O. Beavis, M.D. Am. J. Surg. 98:816 Dec. 1959.

An attempt has been made to throw into sharper focus the importance of the anatomical position of the muscles, nerves, and blood supply of the velopharynx and its surrounding pharyngeal spaces. With the velopharyngeal muscular mechanisms so outlined anatomically, it becomes apparent at once to the surgeon that by freeing the superior constrictors from their bony, ligamentous, and musculofascial attach-

ments, and by dissecting them free from their surrounding lateral pharyngeal spaces, complete mobilization of the muscular components with their nerve supply may be obtained. With a more complete understanding of the anatomy of these structures, the surgical approach to their reconstruction through the lateral pharyngeal spaces has assured functional results that far surpass those obtained in the past. The surgical technic for this approach is described in detail.—*H. J. Bloom.*

■ Medical Hypnosis in Maxillofacial and Plastic Surgery. Herbert A. Ecker, M.D., D.D.S. Am. J. Surg. 98:826 Dec. 1959.

Hypnosis is of particular value in surgery about the head and neck, especially when a general anesthetic would be hazardous or contraindicated. Patients requiring extensive suturing of facial lacerations or intermaxillary wiring of fractures of the mandible and maxilla do not have airway problems under hypnosis. For the same reason hypnosis has been extremely helpful in surgery for cancer of the head and neck in reconstructive surgery. Procedures requiring a change of position during an operation are easily handled by the patient under hypnosis, but are more complicated with the patient under general anesthesia which requires an endotracheal tube and a physical effort of lifting and turning the patient. Control of salivary secretions and reduction or increase in blood flow are possible under hypnosis. A surgeon will find hypnosis useful in other procedures such as removing sutures in nervous adults and children, especially in patients with cleft palates. Postoperative splinting of a wound to reduce spread of the suture line is aided by suggestion. Hypnosis helps the patient to develop extreme confidence in the doctor and his treatment. It gives the doctor a relaxed patient prior to, during, and after surgery and puts him in complete control of the situation. It is not a "cure-all" but is merely another tool to use in the treatment of patients. Perhaps this presentation will stimulate the study and use of hypnosis in maxillofacial practices.—*Myron Kaufman.*

■ An Aneurysmal Bone Cyst in the Maxilla. S. Y. Wang, M.D. Plast. & Reconstr. Surg. 25:62 Jan. 1960.

The case report is presented of an eight year old white girl with the complaint of swelling and pain involving the right face and upper jaw. Roentgenographic examination was inconclusive, showing an expanded bony lesion involving the right maxillary cuspid region. A biopsy was done which was reported as "Compatible with giant cell reparative granuloma." The region was explored surgically and a conservative excision performed. The histopathologic diagnosis was aneurysmal bone cyst.

The aneurysmal bone cyst is a benign, localized, solitary lesion characterized by a prominent bulging of bone. The bulging is caused by endosteal resorption and periosteal apposition of cortical bone due to an underlying expanding fibrous lesion. The pathogenesis of the lesion is not fully established. The majority of instances occur in the long bones and involvement of the maxilla is extremely uncommon. The differential diagnosis should include unicameral cyst, odontogenic cyst and tumors, reparative giant cell granuloma, "Brown tumor" of hyperparathyroidism, and true giant cell tumor.—*Irwin A. Small.*

■ A Foreign Body Simulating a Tumor of the Parotid Gland. David C. Wherry, M.D., and J. Gordon Lee, M.D. Plast. & Reconstr. Surg. 25:59 Jan. 1960.

A case is presented with preoperative photographs of the patient and specimen removed at operation to show how a foreign body with traumatic entrance to the region of the parotid gland can, at a later date, simulate the typical swelling of the parotid tumor. A 42 year old man was admitted to the hospital in February 1959 because of a mass in the region of the left parotid gland of four months' duration. Ten months prior to admission the patient had received a blow to the left zygomatic region of the face with a billiard stick and sustained a superficial laceration. Four months prior to ad-

mission the patient noted the onset of a mass in the left parotid region which became progressively larger. A few weeks prior to admission the patient noted difficulty in opening his mouth. Past history in review of systems was noncontributory. Physical examination revealed swelling, no facial nerve weakness, but definite trismus. Laboratory examination was essentially negative.

The Tumor Board of the hospital concurred in the diagnosis of a left parotid tumor and surgical extirpation was recommended. In the course of surgery, an abscess cavity was entered. On probing this abscess cavity, a piece of wood measuring approximately 3 cm. in length and 0.5 cm. in width was discovered and removed. This was part of the tip of the billiard cue which had entered the parotid gland some ten months prior to the operation through a superficial laceration overlying the left zygomatic process. The wound healed satisfactorily and the patient has been well over a three month follow-up period.

The preoperative photographs and clinical course indicate a presumptive diagnosis consistent with tumor of the parotid gland. This instance illustrates how a foreign body can confuse further the diagnostic picture of pathologic lesions in the parotid region.—*Donald B. Rae.*

■ CREATION OF AN ALVEOLAR RIDGE AFTER BONE TRANSPLANTATION TO THE MANDIBLE. A. Rehrmann, M.D., D.D.S. Plast. & Reconstr. Surg. 24:183 Aug. 1959.

In planning the reconstruction of the mandible, two points have to be kept in mind: (1) to recreate, as nearly as possible, its normal shape, and (2) to restore its normal function. The reconstruction of the mandible is unsatisfactory, of course, if we have achieved a good cosmetic result but have not restored the function of mastication as well. A securely fitting lower prosthesis cannot be made unless a proper alveolar ridge is created. The object of the author's operation is to set free bone, implanted so that it can be embraced, as far as possible, with the margins of the prosthesis.

The principal procedure for alveolar ridge surgery is as follows: A cut is made along a line parallel with the intended ridge. The buccal and lingual tissue layer is lifted off in a downward direction and care is taken to leave the periosteum and a slight tissue layer over the mandible or bone graft to provide the "take" of a skin graft. The lower wound margins are sutured into position near the lower edge of the bone by a special suturing method. After this, the mandible or the implant has the shape of a well-formed ridge. Split skin flaps are fitted to the raw buccal and lingual surface of the bone by means of the patient's dental prosthesis which has been adapted with impression compound. The prosthesis is placed and secured by circumferential wires. It is removed after ten days. The compound is replaced by acrylic resin and the denture reinserted.—*Donald B. Rae.*

■ DISORDERS OF THE BUCCAL MUCOSA. James H. Mitchell, M.D. Am. J. Surg. 98:805 Dec. 1959.

Disorders of the buccal mucosa are numerous, and the differential diagnosis often is difficult. They may arise locally, in conditions such as leukoplakia, mucous cysts, and neoplasms; they may be due to local irritation from such sources as ammoniated toothpaste, nylon toothbrushes, mouth washes, ill-fitting dentures, and tobacco in all its forms; they may be caused by local infection such as moniliasis, streptococci, tuberculosis, trench mouth, or syphilis, or they may be congenital as in hemangioma or lymphohemangioma. An illustrated discussion of the disorders affecting the buccal mucosa is presented. The disorders include benign and malignant neoplasm, buccal manifestations of systemic disease, and local infection. Also included are some disorders of unknown etiology. —*H. J. Bloom.*

Announcements

■ Arizona Governor to Speak at Oral Surgeons' Annual Meeting

Governor Paul Fannin of Arizona has accepted an invitation to appear as guest of honor at the "President's Luncheon" during the forty-second annual meeting of the American Society of Oral Surgeons at the Westward Ho Hotel, Phoenix, Ariz., October 12-15.

Preliminaries of the session will begin October 7 with a two-day meeting of the society's executive council and will be followed by a society-sponsored golf tournament at the Phoenix Country Club October 10.

■ Conference on Oral Cancer to Precede Annual Meeting

Under a grant by the National Institute of Dental Research, a conference on oral cancer will be held in Phoenix October 11, immediately preceding the annual meeting of the American Society of Oral Surgeons.

The program includes the showing of a motion picture, "Surgical Treatment of Pre-Cancerous Lesions," by Col. Robert B. Shira, Walter Reed Hospital, to be followed by a question and answer period, and lectures as follows: Maj. Surindar N. Bhaskar, Armed Forces Institute of Pathology, on the role of the oral pathologist in the diagnosis of oral lesions; Hamilton B. G. Robinson, dean, University of Kansas City School of Dentistry, on the activity of the schools of dentistry in graduate and postgraduate training for early detection of oral cancer; Ernest Wynder, New York City, on the effect of environment of cancer incidence; Gilbert H. Fletcher, Houston, Texas, on the newer modalities in radiation therapy, and Chester Stock, Sloan-Kettering Institute, on a two-year review of research in cancer etiology at the Institute.

■ A.D.A. Scientific Programs of Interest to Oral Surgeons

Three of the many programs scheduled for the scientific sessions of the annual meeting of the American Dental Association October 17-20 at Los Angeles are of special interest to the oral surgeon.

A forum on pain control, moderated by Donald Mackay of St. Paul, will include an examination of pain, its etiology and elimination, together with an analysis of the benefits and dangers in various pain-relieving technics. Participants will be Joseph Osterloh, San Francisco, Morgan Allison, College of Dentistry, Ohio State University, and Harold J. Zubrow, Pittsburgh.

A panel discussion of the Willmar-Winona and Marshall Studies—Pilot Oral Cancer Detection Program will be conducted by James English, Office of Naval Research Code 444, Washington, D. C. Panel participants will be William G. Shafer, University of Indiana School of Dentistry, Marvin

Burstone, National Institutes of Health, and Robert Gorlin, University of Minnesota School of Dentistry.

Gustav O. Kruger will moderate a forum on exodontics and prosthodontics which will be conducted by William Rakower, New York, W. B. Johnson, Camp Pendleton, Calif., and James H. Quinn of the Ochsner Clinic, New Orleans. Another session of this forum will include as speakers, Leo Korchin, Fort Devens, Mass., Frank M. McCarthy, Jr., Los Angeles, and Muller M. DeVan, Philadelphia.

■ Internships Available in New York City Hospitals

A rotating internship to begin in July 1961 is available at Grand Central Hospital, New York, with rotation to Morrisania City Hospital, Bronx. Application can be made to Bernard M. Cohen, director, department of dentistry, Grand Central Hospital, 321 E. 42 St., New York.

A surgical internship at Morrisania City Hospital also is available for July 1961. Both programs are accredited by the American Dental Association Council on Dental Education.

■ Australian Dental Congress in Sydney August 14-18, 1961

The sixteenth Australian Dental Congress will be held August 14-18, 1961, in Sydney, New South Wales. Derek Freeman, 185 Elizabeth St., Sydney, is honorary secretary.

■ Navy Offers New Extension Course in Oral Surgery

A new extension (correspondence) course in oral surgery, NAVPERS 10729, is now available to officers of the Dental Corps of the United States Navy and Naval Reserve.

Developed by the staff of the Naval Dental School, National Naval Medical Center, Bethesda, Md., with the assistance of professional test writers of the home study department of the University of Chicago, the course includes ten lessons, and the material includes a recent edition of a widely accepted oral surgery textbook.

Reserve dental officers may receive promotion and retirement points which are credited on successful completion of course units.

Applications for enrollment can be submitted on NAVPERS 992, Application for Enrollment in Officer Correspondence Course, via official channels to the Commanding Officer (Code 5), U. S. Naval Dental School, National Naval Medical Center, Bethesda 14.

■ Examinations Scheduled for Oral Pathology Certification

The 1960 examinations for certification of the American Board of Oral Pathology will be held December 3 and 4 at the Baltimore College of Dental Surgery, 618 W. Lombard St., Baltimore. All inquiries relative to examination and certification should be addressed to Donald A. Kerr, secretary, University of Michigan School of Dentistry, Ann Arbor, Mich.

■ Many Groups in the Dental Field to Meet in October at Los Angeles

Many of the meetings of special groups which have been scheduled in conjunction with the annual session of the American Dental Association in October at Los Angeles are of interest to oral surgeons. Among them are:

American Academy of Oral Roentgenology, Biltmore Hotel, October 14 and 15. Theodore S. Grant, 508 Sixteenth St., Oakland, Calif., secretary;

American Dental Society of Anesthesiology, Sheraton Townhouse, October 15 and 16. Harry A. Sultz, 249 Linwood Ave., Buffalo, secretary;

Armed Forces Reserve Dental Officers' Association, Mayfair Hotel, October 14-16. Hugh D. Killmer, P. O. Box 17102, Veterans Administration Hospital, Houston 31, Texas, secretary;

International College of Dentists, Biltmore Hotel, October 15 and 16. Harold O. Westerdahl, 4829 Minnetonka Blvd., Minneapolis, registrar;

American Institute of Oral Biology, Hotel Riviera, Palm Springs, Calif., preceding the meetings of specialty groups prior to the A.D.A. annual session. The office of the Institute is at 2240 Channing Way, Berkeley 4, Calif.

■ National Civil Defense Conference at Los Angeles

The Council on Federal Dental Services of the American Dental Association will sponsor a National Dental Civil Defense Conference Saturday, October 15, from 9 A.M. to 12:30 P.M., in the Statler Hilton Hotel, Los Angeles. All Association members may attend, but particular invitations are extended to constituent and component society officers and members of civil defense committees. The conference will include portions of the Navy Dental Corps Casualty Treatment Training Course, and a major talk by Congressman Chet Holifield, Montebello, Calif.

■ Programs on Dental Treatment in Hospitals

Special programs on dental treatment in hospitals have been arranged by the A.D.A.'s Council on Hospital Dental Service. They will take place Tuesday, October 18, at two Los Angeles hospitals. The morning program will be presented at the Los Angeles County General Hospital and will cover oral surgery and general dentistry services; the afternoon program will be held at Orthopaedic Hospital and will cover orthodontic services. Attendance is open to all members registered at the annual session.

■ Society Appoints Oil Executive Founder Trustee

Mr. Elton L. Newton, president of the Hoosier Petroleum Company, Newkott Petroleum Corporation, and other petroleum concerns, has been appointed a founder trustee of the educational foundation of the American Society of Oral Surgeons. The foundation will administer a program of grants in support of national health education in oral surgery. Fred A. Henny, society president, is interim chairman of the foundation's board of trustees.

■ Dental Faculty and Research Personnel Registry Established

The establishment of a Registry of Dental Faculty and Research Personnel has been announced by Raymond J. Nagle, president of the American Association of Dental Schools. The Registry, administered by the central office of the association at 840 North Lake Shore Drive, Chicago, is not a placement bureau, but is designed to serve as a "clearing house" for dental education institutions and persons interested in teaching or research positions in the dental schools. Information about the Registry program and copies of the application form can be secured by writing to the association.

■ Dentists of South India Need Books and Instruments

Books on dentistry and oral surgery, and used instruments and equipment are sorely needed by the dentists of South India who work among the inhabitants of impoverished villages, according to P. F. John, a dental surgeon of Alwaye. The American Dental Association has dispatched a packet of books and pamphlets to Dr. John to serve as the nucleus of a library. Individuals wishing to contribute can send books and instruments to him at Market Rd., Alwaye, P. O., S. India.

■ Greater New York Dental Meeting December 5-9

The thirty-sixth Greater New York Dental Meeting will be held at the Hotel Statler Hilton, New York City, December 5-9. M. Purdy, 106-A, Hotel Statler Hilton, is executive secretary.

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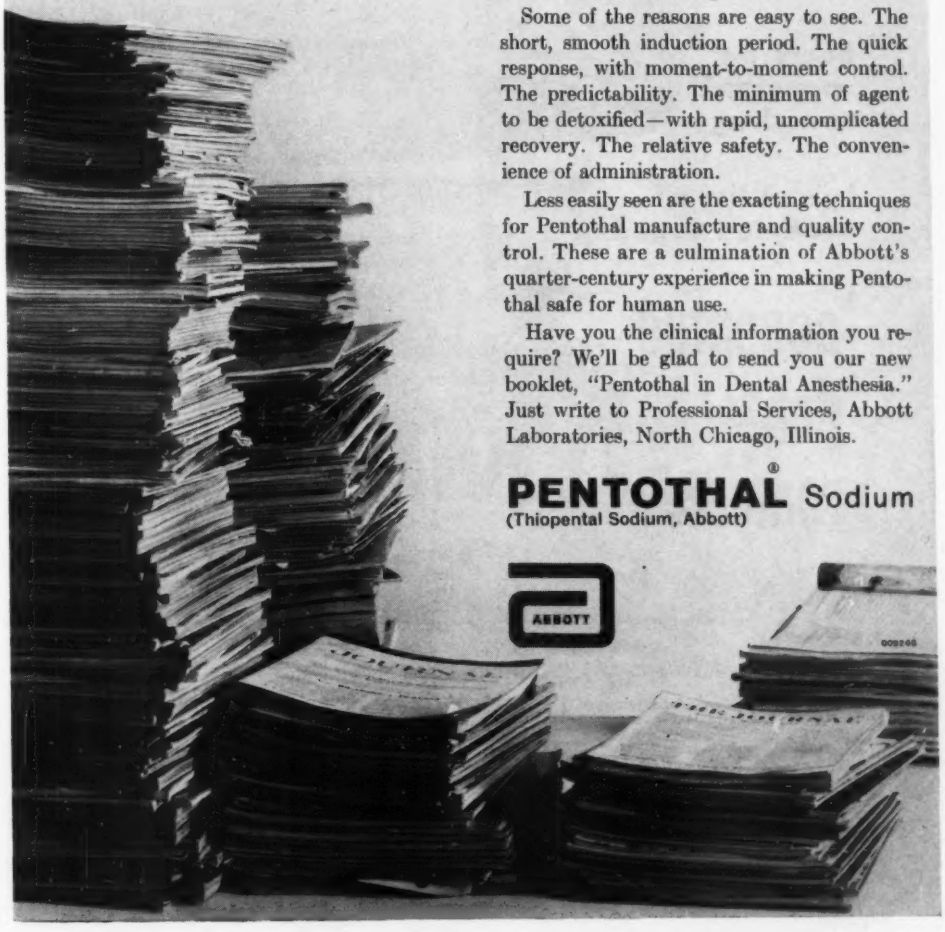

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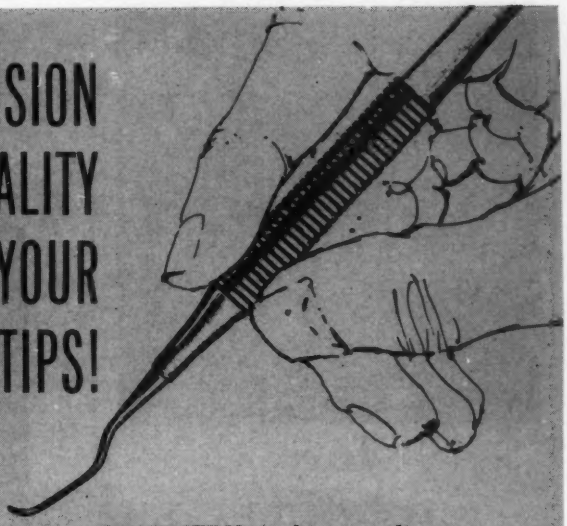

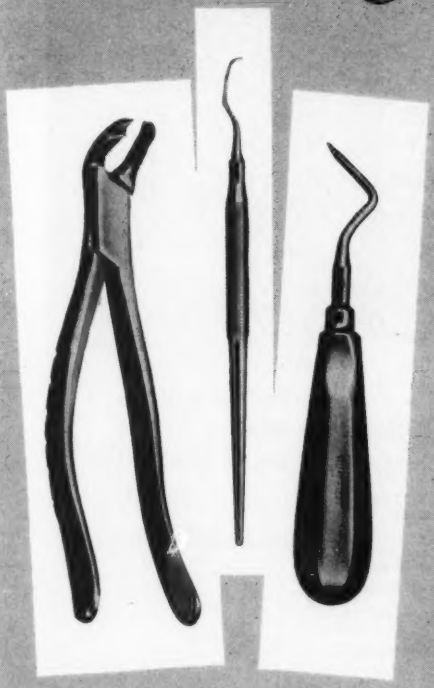

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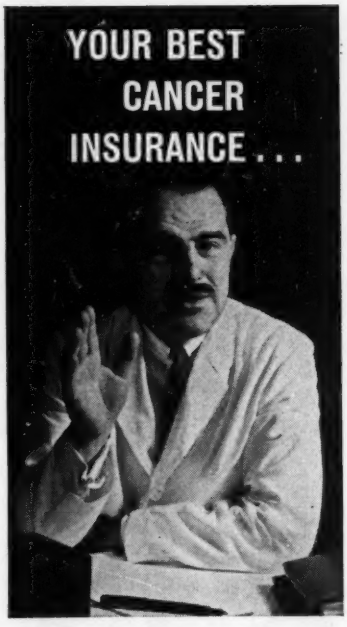

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